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Applying Navy Methods in Apprentice Training

By A. H. Rodrick

THE need for an attractive apprenticeship system is apparent today because manufacturers have an economic difficulty which they cannot disregard without eventual embarrassment. There is an apparent desire on the part of the American people to have their sons avoid engaging in industrial work. The dream of the father of today is to have his son pursue some vocation better than that of his dad. It is the common parental ambition. We compel our children to go to school; we expend money for their education; we are disappointed if they fail to take advantage of their opportunities. With the many educational opportunities presented for training for positions more lucrative and requiring less physical exertion, coupled with the fact that lack of education in the present age is likely to be condemned rather than excused, the average youth is turning from the factory for a vocation, rather than toward it. The factory manager must be prepared to meet such changes from the regular order of things. The solution for such a problem lies in trained personnel, and the best method of training employees for future usefulness and for stability of employment is by a system of apprenticeship.

Apprentice training, to compete today against social conditions that tend to draw boys away from the shop, must be attractive. By efficient organization, personal touch, and assured thoroughness, the Navy has put much of this desired element into its apprenticeship courses

The kind of apprentice system to be used depends upon the size of the industry, the character of work, and the number of employees to be trained. The Navy Department has a system in use at its industrial establishments, whereby apprentices may be trained for any trade ordinarily requiring an apprenticeship in number not exceeding 20 per cent of the artisans employed in the trade. The principles of this system are applicable to any type of private factory.

Apprentices are appointed from eligible registers maintained by the U. S. Civil Service Commission as a result of competitive examination, and the age limits for employment are between 16 and 22, if not in conflict with the laws of the state in which the establishment is situated, except that age limits for original appointment are waived for those entitled to preference because of military or naval service.

The examination consists of mental and mechanical aptitude tests. Applicants are required to pass a physical examination, and they must be physically sound and in good health. They must have good eyesight, must measure at least 4 ft. 8 in. in height, and weigh at least 95 lb. in ordinary clothing. The normal length of apprenticeship is four years. Every apprentice, upon entering, is rated as apprentice, fourth class, in which rating he is required to serve a minimum of 2,156 shop and school hours. He may then be promoted to the rating of apprentice, third class, in which rating he is required to serve a minimum of 2,156 hours. He may then be promoted to the rating of apprentice, second class, and to apprentice, third class in which ratings he serves 2,156 hours each. Thus it will be seen that an apprentice attains a journeyman status after having completed a total of at least 8,624 hours of training. Those who have completed one year or more of a course in a technical or vocational school of recognized standing, are permitted to compete, after their employment, in the next succeeding examination, and if found qualified are advanced to whatever higher class their education, training and aptitude may warrant. Any employee who has established at least one year's prior training or service, either as helper or apprentice in the trade, in a Naval establishment or outside, is likewise permitted to compete for the next higher class. The labor board appraises the character of experience and its equivalent in hours of apprenticeship in the naval establishment. Vacancies in the allowed quota, which are filled only semi-annually after the promotion

examinations, are filled from among eligible employees before recourse to the register established as a result of competitive examination.

For each trade in which apprentices are employed, a schedule covering the essentials of the trade and the period of training in each element is arranged. These schedules are on shop record forms, on which are entered detailed chronological records of the service of apprentices. Apprentices are assigned to work in accordance with the schedule, in order that the trade training may include all the essential elements in their proper sequence.

When, because of suspension of work, the services of apprentices are not needed, they are furloughed. They receive no pay during furlough, and when work is resumed they are recalled in the order of class; that is, all first-class are taken back before any of those in the second class, and so on. Within each class efficiency governs the order of recall.

Upon the completion of the service required of an apprentice he is awarded a certificate certifying the completion of apprenticeship in the trade, and he is promoted to artisan in his trade, regardless of age, his rate of pay being determined by the head of the department.

A School at Each Yard

At each navy yard, and at each station where the number of apprentices warrants it, an apprentice school is established. Apprentices are required to attend school, and the grades assigned by the instructors are considered when determining promotions. School hours are during the regular working hours, and apprentices are paid their regular rate while attending school. The courses are laid out so as to provide classroom instruction averaging six hours a week for the entire apprenticeship. Apprentices are grouped for instruction at the school with respect to their knowledge of the subjects taught, and the semi-annual examination covers the subject matter in which they have received instruction. The apprentice school is for the education of apprentices in continuation of their schooling, as distinguished from trade training, which is given in the shops.

Instruction in the school embraces: Mathematics; English, including report writing and letter writing; making and reading drawings; elementary physics; and lectures on subjects connected with their trade. The necessary tools, books, and schoolroom accessories used by apprentices in connection with their training are furnished by, and remain the property of, the Government.

Where the number of apprentices employed warrants it, a supervisor of apprentices is employed, who, with the co-operation of shop supervisors, arranges the schedules for trade training, and has supervision of the work of all apprentice instructors. He maintains a record of each apprentice, and through personal interviews guides the apprentice to a successful completion of apprenticeship.

Employees assigned as instructors at the school are selected because of their qualifications to teach the subjects they are to present. They assist the supervisor of apprentices in preparing the outlines of instruction in the school. The co-operation of the local board of education is invited and the school instructors may be provided by said board.

An artisan in the trade may also be assigned as a shop instructor to assist the master workman in instructing apprentices. It is his duty to see that apprentices understand how to undertake the jobs assigned, and to instruct them in the proper use of the tools with which they work. When there is no shop instructor, the trade training is given by the supervisors and artisans of the shop.

Examinations for promotion, retention at present rate, or discharge, are held semi-annually, and these determine whether the apprentice has made satisfactory progress in his trade and studies, and whether conduct and attendance have been satisfactory. At the same time the master workman or other supervisor having apprentices under his supervision during all or a part of the preceding six months submits a report showing the trades assigned by him for conduct and progress in trade. Attendance, behavior, obedience, respect, alertness, neatness, reliability, and attention to safety principles, are considered in assigning the grade for conduct. Quality of work and interest are considered in assigning the grade or progress. Report of unsatisfactory conduct or progress is made to the parent or guardian of the apprentice at regular intervals.

Each apprentice upon employment is informed that his first 2,156 shop and school hours' work is considered a trial period, during which period he may discontinue apprenticeship upon the presentation of a written resignation approved in writing by the parent or guardian. After a service of 2,156 hours, he cannot discontinue apprenticeship unless his written resignation stating why he wishes to resign is approved by the commanding officer. A violation of this procedure results in discharge for cause, and an employee so discharged cannot be re-employed for a period of one year.

Not Sacrificing Education

Under such a system it will be seen that for every 100 artisans in the trade 20 apprentices are in training to meet an emergency or serve as replacements. The rate of pay for apprentices is graduated by classes. Boys can be secured at a lower wage since the education they obtain while receiving pay is also measured in dollars and cents. An educational feature of any apprentice system will tend to attract the average boy to the factory because in seeking trade employment with such an advantage he feels that he is not sacrificing an education by going to work.

Systems of apprenticeship are usually looked upon as applying to minors only, but the fact is that men also are susceptible to training when given the opportunity to demonstrate ambition and ability. The helper can be trained as an operator, and the operator as a skilled mechanic. Of course, a higher rate of pay must be given the adult, but training can be carried on during regular employment, either during working hours or thereafter, at a small cost which will more than pay for itself in the future. If carried on during working hours, it can be made compulsory.

If a man knows that he is receiving training for a better job with a higher rate of pay, he is more likely to take added interest in his employment than if he thinks that he can advance no further in the organization. The workman would like to have it said of him "from helper to shop superintendent." The training he receives, even though it may seem slight, is often sufficient to arouse a latent qualification and to furnish the desire to secure additional education and training from study at his own expense.

The contention may be voiced that apprenticeship or employee training does not pay because the novice, after becoming a journeyman, or the employee after being trained, leaves his employer to accept employment elsewhere, and thus the employer's competitor receives the services of the man. But, on the other hand, one method of stabilizing the force is by training the employees for better positions. In this way, vacancies are filled in the higher paid grades by promotion within the organization. With such a plan in effect, employees are not likely to seek employment elsewhere in large numbers. Prospects of advancement stimulate ambition in any man. Employee training, moreover, develops specialists in the organization, that is, men who have been trained in the particular line of work, and upon whom reliance can be placed to carry through production requirements.

In conclusion, it is well to point out the distinctive advantages to be gained from apprenticeship and employee training. It serves as a means of preparedness for such industrial changes as affect the procurement of capable and qualified workmen. It is one of the means of creating a greater stability of employment. It permits the filling of vacancies by workmen trained in a particular line of work. It aids in maintaining a contented working force because it makes possible the promotion of the company's own men.

Finishing Cylinder Bores and Other Round Surfaces

By Frank C. Hudson

THE finishing of cylinder bores continues to be a live topic in all automotive centers. Not that there is much difference of opinion as to the advisability of what we call honing, but the exact method has by no means been standardized. Nor does standardization seem likely until we find, and use, a cylinder iron of standard grain and hardness, if such a thing be practically possible. For just as we found wide differences as to the solid wheel used in the old method of cylinder grinding, so we find the same problem confronting the user of hones or grinding-heads.

According to good authority on the subject, there is no one best grit and grade for the stones, or abrasive blocks or hones, any more than there is for grinding wheels. The selection of the proper abrasive depends on the iron to be surfaced, on the speed at which the hone, or grinding head is run, the rate at which metal is to be removed and the finish desired.

A Polishing Operation

Lapping in the old days meant using a powdered abrasive on a plug lap of wood, lead, copper or cast iron, and was usually confined to small holes, although occasionally flat surfaces were lapped by these methods. The abrasive was either fed to the work in the form of a paste, or rolled into the lap, as when diamond dust was used. As ordinarily performed, lapping is more of a polishing operation than anything else. Real lapping removes an appreciable amount of stock and corrects slight inaccuracies left by reaming or solid wheel grinding.

According to one authority on lapping, the main requisite is to have the lap of somewhat softer material than the work, so that the abrasive will imbed itself in the lap rather than in the work. The lap must, however, be sufficiently hard to hold the abrasive in the fixed position with regard to the work. For lapping crankpins or main crankshaft bearings, for example, a very soft cast-iron ring may make a good lap. The ring must be split and then be clamped together on shims or in some solid manner. In this way the high spots of the crankpin or shaft are lapped down, while with any flexible lap, the lap would follow the entire surface of the pin. Lignum-vitae wood also makes a good lap, and is preferred by some. The condition of the work after lapping tells when the lap is too hard. If the lapped surface is dull, or has a frosted appearance, the lap is too hard—some abrasive has been forced into the work. The lapped surface should have a high polish.

While the early builders of automobile engines lapped the cylinders with dummy pistons and abrasives of various kinds, including sapolio, only one large builder continued this practice over an extended period. The present "honing" is a modification of machine lapping as practiced by this concern. Most of the early honing was done with flexible hones—which were stones, or blocks, of abrasive held in spring-backed containers. Being free to move radially, these blocks followed any inequalities left in the cylinder by either reaming or grinding.

The use of the rigid hone, adjustable in diameter to permit easy entry into the cylinder bore, and expansion to a definite, fixed diameter, makes an entirely different operation. Such a grinding head, no matter what we call it, can and does correct inequalities in the bore. And this quality seems to put it in the "grinding" class. Then, too, this kind of a head can remove an appreciable amount of metal. For while the usual amount left for this final operation does not exceed 0.002 in., it is an easy matter to remove 0.005 in., and in a comparatively short time.

Opinions also differ greatly as to the proper speed, both of revolution and reciprocation. Some shops are securing excellent results with one set of speeds, while others find that very different speeds give equally good results. Hardness of the metal to be cut and the abrasive used, have their effect, and they account for different results obtained.

Crossed Grinding Marks

After all sorts of combinations of high rotative speeds and slow reciprocations, and vice versa, there seems to be a sort of agreement that the reciprocations shall be less than the rotations. The object sought is to have the grinding marks cross each other diagonally so as to form small diagonals. This sort of surface is supposed to be more readily worn in to a perfect bearing by the piston rings.

The appearance of a cylinder finished by this process —whether we call it honing or some form of grinding, is different from that formerly considered proper, just as the use of ring or cup-wheels left a surface that required education for its acceptance. But the apparent scratches in either case are very shallow. In some cases they are said not to be over 0.0001 in. It is further said with cylinders so finished, that the marks entirely disappear after 50 miles of engine use, leaving a glass-smooth surface.

As with any other method of finishing, the results

depend largely on the operations that have gone before. If the hole has been carefully reamed or ground, there is little for the last lap, hone or grinding head to do, and the better are the results secured. For, while it is possible to remove considerable metal in the finishing operation, it is seldom advisable to do more than correct the slight inaccuracies that are due to modern commercial tolerances.

Nor is this method of finishing holes confined to cylinder bores. There are many other applications and their number seems to be increasing. One of the latest developments in this line is the use of these new grinding tools on piston-pin holes, some of which are as small as ¾ in. in diameter.

Both lapping and the new methods of grinding have their place in modern machine building, in order to secure the greatest commercial perfection in bearings of various kinds.

Unilateral Tolerances, Standard Holes and Reamers

NEW ideas and methods usually gain ground slowly —and for several reasons. Advocates of change are prone to assume that others have studied the question as much as they, and should be familiar with the advantages of the new method. As a result, all the reasons for the change are rarely explained and though the partially interested man may be tempted to try it, he bumps into many snags that are disconcerting. There is enough inertia in most of us to make changes more or less difficult even if there were not material obstacles in the way, such as present tools, gages and other equipment.

Unilateral tolerance is one of the practices that is not fully understood in all shops. And reamer wear is one of the arguments advanced against it. With a plus-or-minus tolerance, reamers are permitted to wear below basic size before being discarded. But as shafts can also run above basic size there can be cases where pieces that are within the prescribed limits will not go together.

In order to give as long a reamer life as possible, regardless of the system used, makers of reamers give them a definite amount of over-size when new. Some users seem to have an idea that this is done to permit various kinds of fits to be secured, but such is not the case, since with "standard hole" practice, any variation from basic size to secure loose or other fits, is made in the *shaft* and not in the hole. The over-size of the standard reamer is to permit it to have a reasonable wear-life before getting below the basic size. When definite sizes above basic are required it is necessary to have special reamers.

The amount of oversize on standard reamers is given by one well known concern as follows:

Up to ½ in.	plus	0.0001 to 0.0004 in.
½ to 1½ in.	"	0.0002 " 0.0005 in.
1½ to 3 in.	"	0.0003 " 0.0006 in.
3 to 6 in.	"	0.0004 " 0.0007 in.
6 to 12 in.	"	0.0005 " 0.0008 in.

While these tolerances give considerable wear-life to the reamer, it will readily be seen that the over-size does not, and can not, take care of allowances for the different classes of fits. Even with the bilateral method of tolerances, the amount above basic, when new, would not give much lee-way when it comes to allowances.

Even with the over-sizes given, some users complain that it takes a very skillful workman to secure a standard-sized hole with a standard reamer, since in some work (especially with fairly long holes) reamers seem to cut undersize, owing to a slight compression of the metal in the blades or a deformation of some kind. On the other hand, the same reamer may ream a short hole slightly oversize. One person reports seeing a man ream holes from 2.000 to 2.004 in. with the same reamer, nominally of 2-in. diameter. He claims that the tendency toward large holes seems to be greater with machine reaming than when the reaming is done by hand.

There may not seem to be much connection between unilateral tolerances, and reamers that ream various sizes. But the point is that with unilateral tolerances and stand-and hole practice, the holes need not be above basic in order to make the desired fit, since the allowance for oil film or other looseness of fit, is always made on the shaft.

If advocates of unilateral tolerance will take the time to state all the facts of the case to those who are interested, there will be less difficulty in overcoming criticism and in making converts. The question of reamer wear is not a serious obstacle in these days of really good adjustable reamers. And it must not be forgotten that the use of the standard shaft, instead of the standard hole, involves the use of various special measures to secure the desired fits.

Limit Gages, Their Use and Application —Discussion

By P. H. White

IN AN article under the title given above by M. E. Harold, and published on page 363, Vol. 66, of the *American Machinist,* a plug gage similar to the one shown in Fig. 1 was used as one of the illustrations. While this gage may serve its purpose, there are certain improvements shown by Fig. 2 which not only make it simpler to construct, but also much quicker and easier to use.

In the first place, the square ends shown in Fig. 1 require that the gage be skillfully handled to make it

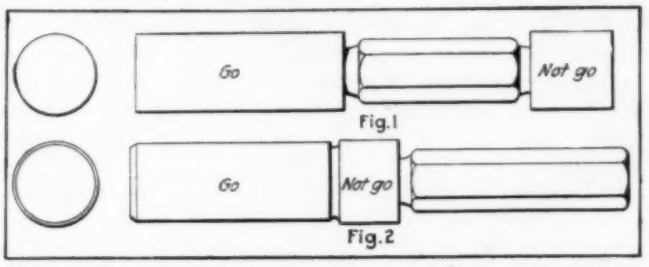


Fig. 1—The gage discussed. Fig. 2—The gage proposed

enter the hole. If the ends are slightly chamfered as shown in Fig. 2 the gage can be inserted much more easily.

In the second place, after the "go" dimension has been checked, the gage must be withdrawn and reversed in order that the "not-go" dimension may be checked. If the gage is designed as in Fig. 2, it is necessary merely to push the gage through the hole until it comes to a stop. The "go" section acts as a pilot for the "not-go" section, and one insertion completes the gaging.

In practice, if it is desired, the gages used by the inspector on the job may be made with tolerances somewhat smaller than those used by the chief inspector.

Reconditioning Locomotives with Modern Equipment

By FRANK W. CURTIS
Western Editor, American Machinist

Machine and erection shop laid out to handle group repairs economically—Longitudinal pit tracks have capacity for thirty-five locomotives—Valve-setting machine

ALTHOUGH the Denver, Colo., shops of the Chicago, Burlington & Quincy R.R. are three years old, they stand prominently in the front rank of locomotive repair shops. From the layout shown in Fig. 1, it will be seen that the arrangement of machinery and equipment has been well planned, and that the grouping of units permits economical handling of repair work. The reconditioning of locomotives operated in Colorado, Wyoming and Western Nebraska, and those of the Colorado & Southern Ry. is handled at this point.

The shops, 506 ft. in length and 240 ft. in width, stand in the center of a 280 acre tract. They are divided into three bays, namely; the heavy- and the light-machinery bays; and the erecting bay. The machine bays are 70 ft. in width and 32 ft. in height; the erecting bay is 100 ft. in width and 50 ft. in height.

The first article. The second will appear in an early issue.

The erecting bay has three pit-tracks spaced 30 ft. apart, thus giving ample clearance for accessibility to the engines undergoing repairs. The tracks, extending the full length of the shop, accommodate thirty-five locomotives. This bay is served by two 125-ton traveling cranes on the upper runway, each crane being equipped with a 15-ton auxiliary hoist. The lower runway carries a 15-ton crane for handling parts during erection.

The east machine bay, used for heavy work, is served by two 15-ton traveling cranes, and twenty-five jib cranes equipped with high-speed hoists. Work on wheels, driving-boxes, valve-motions, crosshead-guides and pistons is handled in this bay. The west machine bay, used for lighter work, is served by eleven jib cranes also equipped with high-speed chain hoists. A runway has been prepared for the future installation of a 15-ton travel-

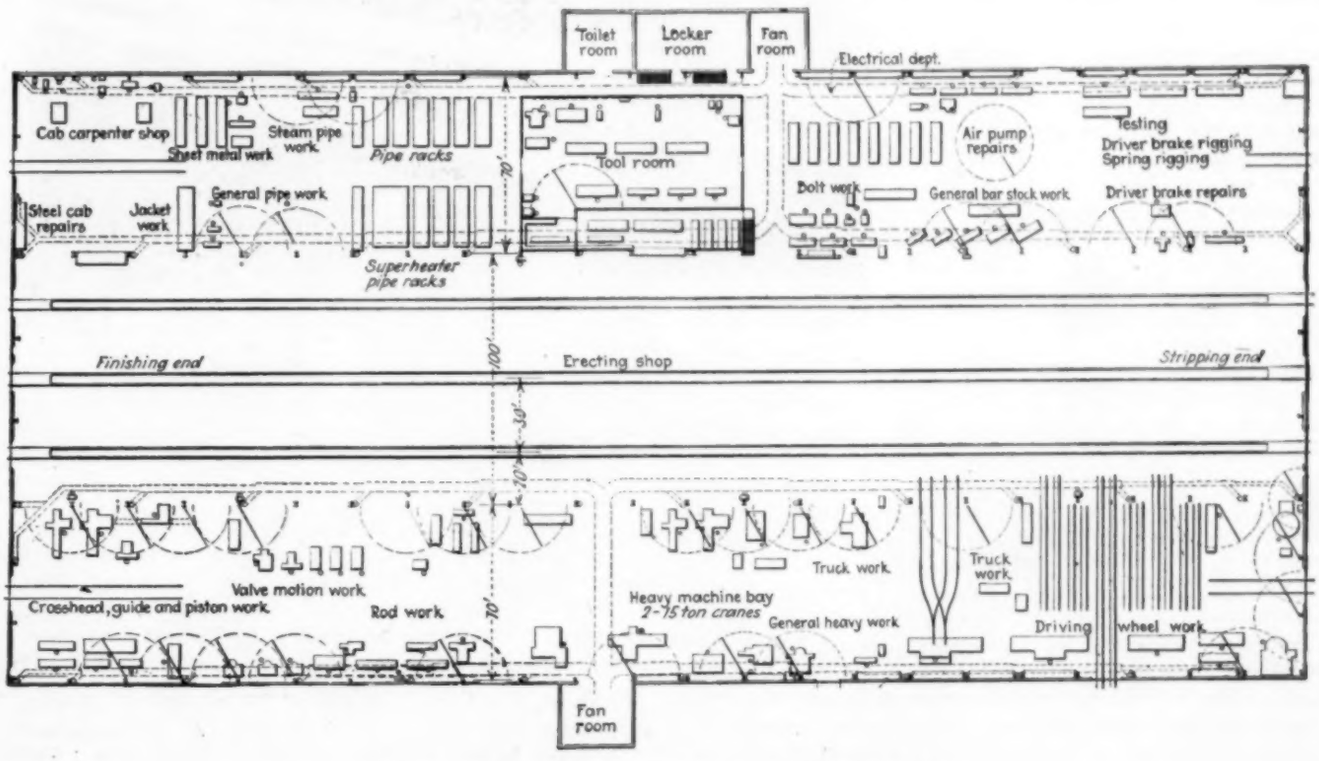


Fig. 1—Layout of the machine and erecting shops

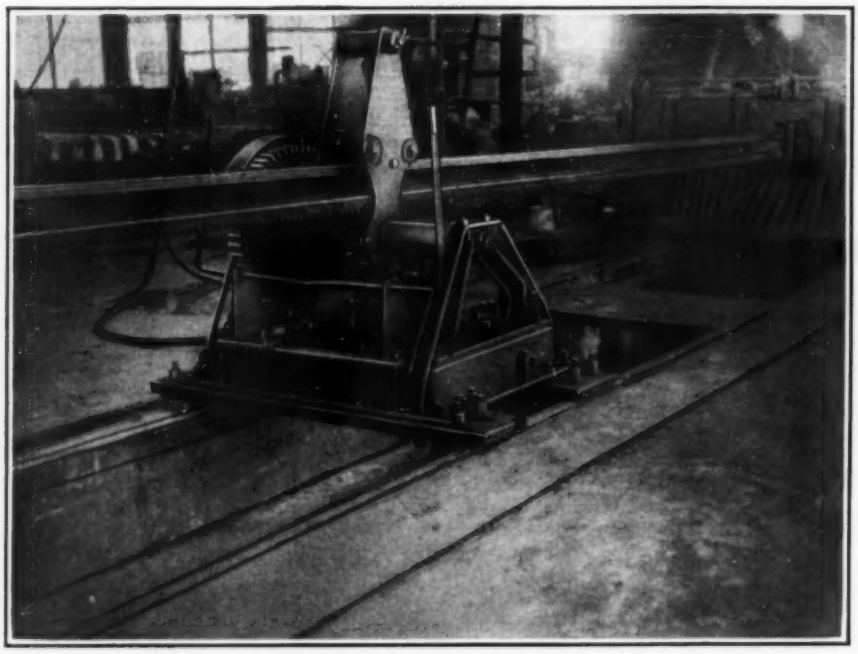


Fig. 2—Portable air-operated device to aid in setting valves

ing crane. In this bay, air-brake, brass, bolt, general bar-stock, electrical, dry-pipe, driving-brake, toolroom and tin-shop work are handled. In all, there are approximately 125 machines in the shop. All machinery is equipped with individual motor drive and automatic push-button control. All bays are supplied with steam, water, air and electricity. Suitable outlets are furnished for oxygen and acetylene at convenient points, as well as alternating-current connections for the operation of portable electric welders. Lighting has been given careful consideration. An intercommunicating telephone system and an automatic signal-light system are provided. Locomotives received for repair, enter the north end of the shop, shown at the upper right in the illustration. They are backed in, so that when they reach the finishing end they will be in the proper position to have the tanks attached. This feature saves much handling that would be required if the engines entered head first. After stripping has been completed, the engines are moved to a convenient stall in the central portion of the track pit. They remain in this location until they are ready to be wheeled. From here they are moved to the finishing end shown at the upper left. Units that can be finished and fitted in the machine shop, are so handled before being delivered for erection.

A device to aid in setting valves and assembling connecting rods in the erection shop, is illustrated in Fig. 2. The unit comprises an air-driven mining hoist that engages a rack attached to the foot of a 20-ft. rail. One end of the rail has a coupling that is attached to the engine having the valves set. The device, clamped to the rails in the pit, is controlled by a lever that operates the rail in either direction. The top face of the rail is guided by two rollers, so that the rack cannot come out of mesh with the driving pinion. To safeguard the operators working on the locomotive coupled to the rail, the following sign is printed on the side of the upright member: "The operator of this machine must know that everybody is in the clear before moving the engine." Inasmuch as the drive is operated by a double-gear reduction, it is possible for the engine to be moved very slowly. Shoe and wedge fits of driving boxes are machined on a planer equipped with the indexing fixture illustrated in Fig. 3. Two driving boxes are clamped on the revolving table of the fixture by strap clamps. As illustrated, one box has been removed to show the construction of the fixture. The driving boxes are centralized by equalizers, one of which is shown at *A*. The revolving member of the fixture is locked in position by a pin passing through it and into the stationary base. The

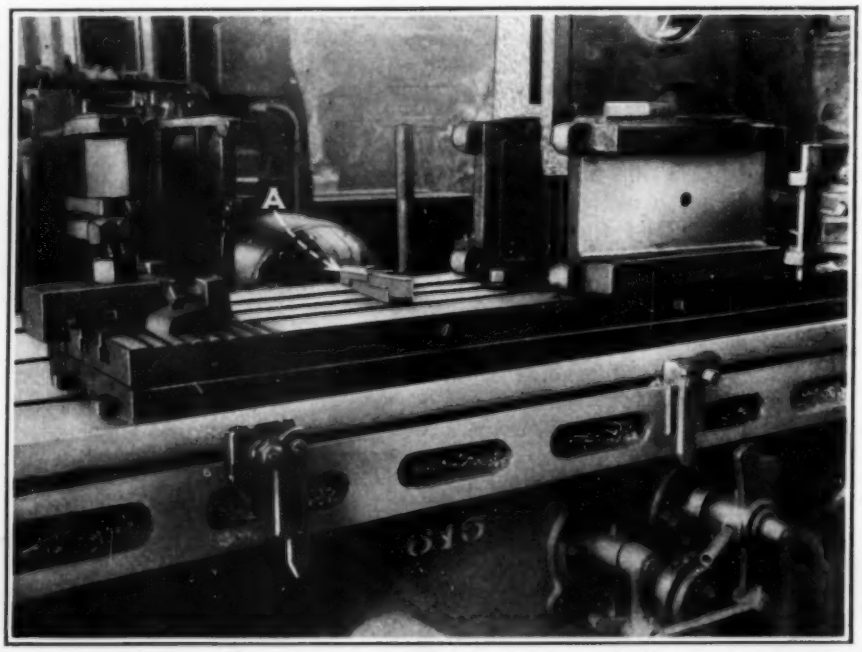


Fig. 3—Fixture for machining shoe and wedge faces of driving boxes

boxes are machined on one side, after which the fixture is indexed 180 deg. so that the opposite sides are in position for machining. In this way, a uniform cut is taken from each side. A pair of boxes is completed in 1 hr., floor-to-floor time.

The growth of household appliances is providing a market for more materials and more machinery than we realize. The consumption of copper in washing machines for example, has reached 10,000,000 lb. a year.

Civil aviation is coming along. From present appearances there will be over 80 cities in the U. S. connected by airways before the end of 1927. Last year 1,536 commercial planes flew more than 23,000,000 miles.

Machining and Measuring Gear Teeth

By EARLE BUCKINGHAM
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Lees-Bradner involute form tester and Copland Chart for use with it—Testing profiles by projection—Composite tests for cumulative errors and smoothness of operation

THE Lees-Bradner gear tester, shown in Figs. 25 and 26, is another instrument for testing the accuracy of involute profiles, but it is developed in greater detail than either of the preceding ones. The base of this testing machine carries the base-circle disk *A* with provision for holding the straight-edge *B* in contact with the base-circle disk with sufficient pressure to insure that it will rock around this disk without slipping. The contact lever *C* is mounted upon the straight-edge with its point in line with the side of the straight-edge that forms the tangent to the base-circle disk. The two rolls *H* are mounted upon ball bearings carried by the sliding frame and are held against the straight-edge by spring pressure, which can be adjusted by the tension screw *K*. The entire frame is pivoted upon the arbor that holds the base-circle disk. When the frame is moved about this center, the straight-edge is caused to rock upon the base-circle disk, which remains stationary, and the point of the lever *C* traces the involute curve of this base circle.

Any movement of the lever *C* away from the true involute curve is magnified by means of the lever *D* and caused to register on the dial indicator *J*, each division of which indicates a movement of the point of the lever *C* of 0.0001 in. A line on the block *L*, which is carried by the straight-edge, indicates upon the graduated scale *F* the distance that the straight-edge has been rocked around the base-circle disk. This distance, divided by the radius of the base-circle disk, gives the angle in radians that the straight-edge has been rocked. It is thus possible to determine when the contact point of the lever *C* reaches certain successive positions on the involute curve.

Fig. 26 shows a gear in position for the testing of its tooth profile with the point of the lever *C* engaging one tooth of the gear, which is clamped over the base-circle disk by means of the nut on the upper part of the arbor. The dial indicator is usually set at zero when the pointer touches the tooth profile at the base circle, or when the pointer touches the tooth profile at the bottom of the working depth when this point is outside of the base circle. The line in block *L* coincides with zero on the scale *F* when the point of lever *C* is at the base circle. When the teeth are not deep enough to reach the base circle, the readings will start a few divisions beyond the

The fourth article. The fifth will appear in an early issue.

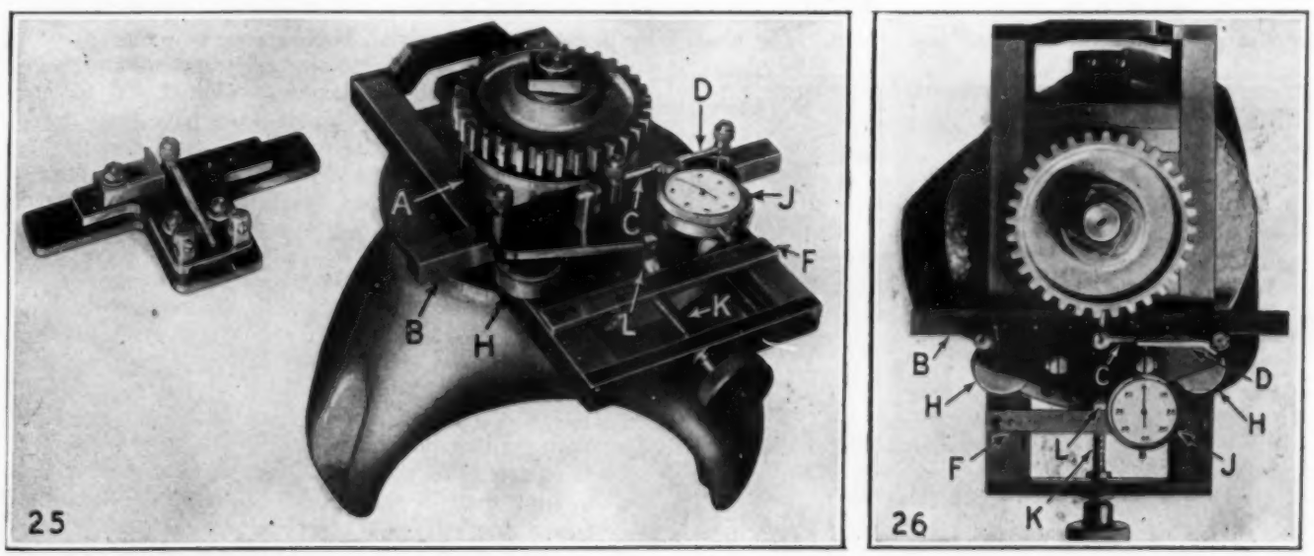


Fig. 25—Lees-Bradner involute profile tester. Fig. 26—Plan view of the Lees-Bradner profile tester

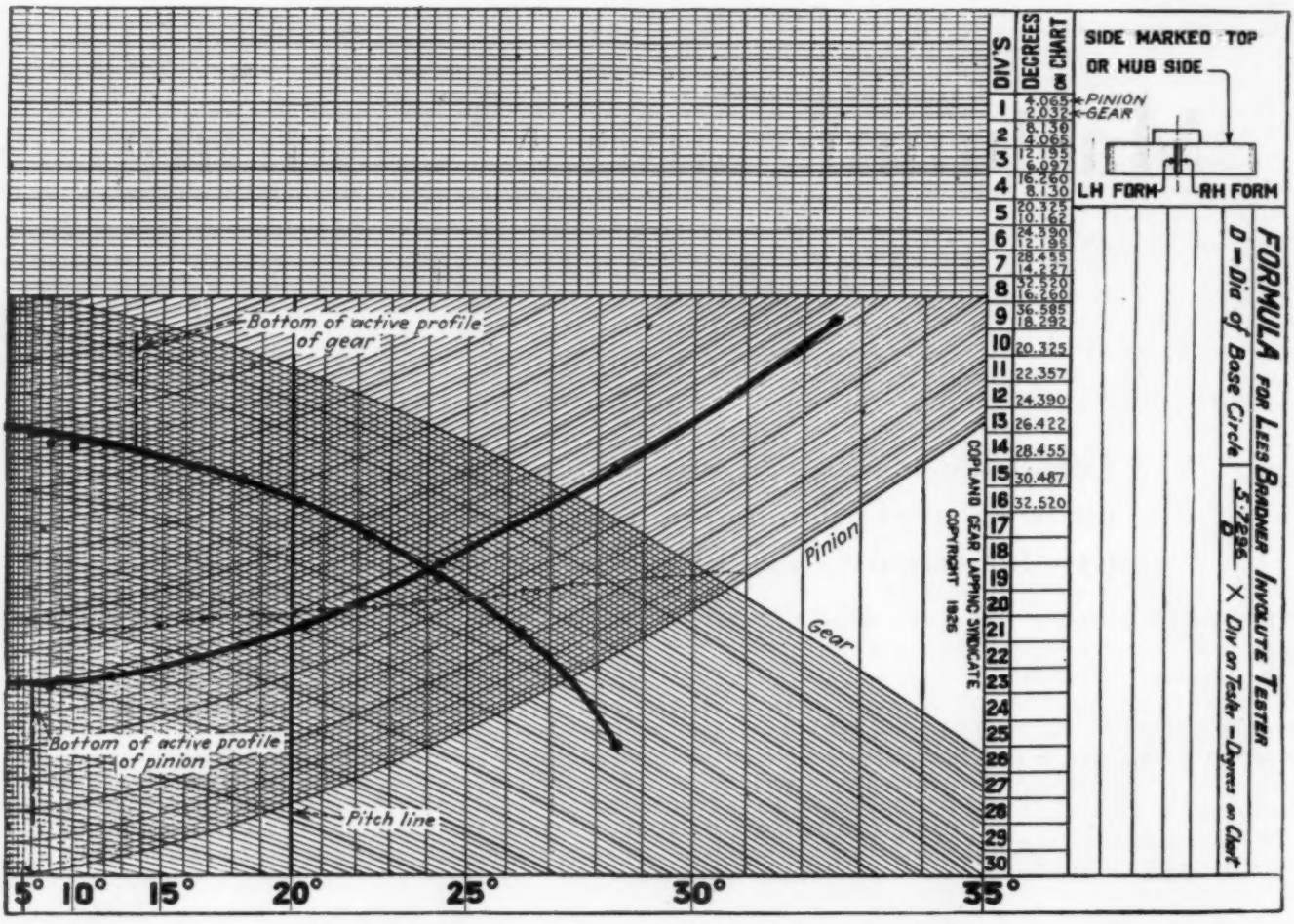


Fig. 27—Copland chart for use with Lees-Bradner profile tester

zero. The frame is now moved to rock the straight-edge upon the base circle, causing the contact point of the lever to travel along the profile of the gear tooth and the indicator to register the variations.

The graduations on the scale *F* mark off a number of successive positions of the point of the lever *C* as it travels up along the profile of the gear tooth so that a record may be kept of the indicator readings at each of the scale graduations. This record may be plotted and the resulting graph not only makes a very convenient manner in which to keep the records but also gives a graphic picture of the form of the profile. The chart shown in Fig. 27 provides a very valuable record of this sort.

Fig. 28—Projection method of testing tooth profiles

This chart provides a place to keep the record of both the profile and the spacing of any gear. The curved lines on the profile chart are approximations to the involute form, while the vertical lines represent equal angular divisions along this involute profile. A formula is given and a place is provided to record the angular motion of the straight-edge in degrees and decimals of a degree for each of the divisions on the scale *F*. This enables the records of the indicator readings to be readily plotted on this chart. The distance between adjacent curved lines may represent any arbitrary amount, usually 0.0001 in., as in the example plotted. After the tooth profiles of a mating pair of gears have been tested and recorded on these charts, it is a simple matter to solve graphically for many of the contact conditions, such as duration of contact, height of active profile, etc. To do this, the pitch line is first established on this chart. If the gears are to run, for example, at a pressure angle of 20 deg., this pitch line will be at the 20-deg. vertical line on the chart. The indicator on the testing machine will fall off rapidly when the top of the tooth profile has been reached. This enables the position of the top of the active profile to be established on the chart. This will be somewhere between the last two readings made. If, for example, this position comes at the 35-deg. line on the chart it tells us that there will be 15 deg. of action on the addendum of this gear against the dedendum of its mating gear. This enables us to establish the position of the bottom of the active profile on the chart of its mating gear. If the mating gears are of equal size,

there will be the same angular action on the dedendum as on the addendum, and the bottom of the active profile would be at the 5-deg. line on the chart.

If the gears are not of equal size, the angular distance on the dedendum of the mating gear will be inversely proportional to the ratios of the tooth numbers. Thus if the mating gear is twice as large as the first gear, this position will be one-half of 15 deg., or 7½ deg. below the pitch line, or at the 12½-deg. line on the chart of the mating gear. On the other hand, if the first gear had 30 teeth and the second gear 20 teeth, this position will be 30/20 of 15 deg. or 22½ deg. below the pitch line. As this would bring it below the base circle, where involute contact cannot take place, it would indicate that the tooth design developed interference. In like manner the top of the active profile of the second gear would be established which would enable the position of the bottom of the active profile of the first gear to be located.

The angular distance between the top and the bottom of the active profile on the chart gives directly the angle through which contact takes place. If this angle should be 25 deg., and the number of teeth in the gear is 18, making angular tooth intervals of 20 deg., this means that contact exists through 25/20, or 1.25 tooth intervals.

The radius of the pitch circle and the radius of the base circle are always known. The difference between these two radii is represented on the chart by the distance between the zero-degree line and the pitch line. This enables the linear scale of the chart in the direction of the height of the tooth to be readily determined. Thus, for example, if the difference between the pitch radius and the base circle radius is 0.095 in., and the distance on the chart to the pitch line is 3.250 in., the chart gives a magnification of the tooth profile in height of 3.250/0.095 or of 34.2 times the actual size. Knowing this scale of enlargement, it is a simple matter to determine the height of the active profile.

A little study of this chart will make apparent how sensitive the involute form is near the base circle. The angular divisions are very close together at this point. Regardless of the actual shape of the tooth on this part of the profile, the indicator on the testing machine will register no movement for the first two or three divisions on the scale because the pointer will be in contact with the highest adjacent point on the tooth profile and remain in contact with it during the motion of the straight-edge through the first few divisions. Any readings on this part of the involute profile will always be questionable.

As a definite example, we will plot on this chart the

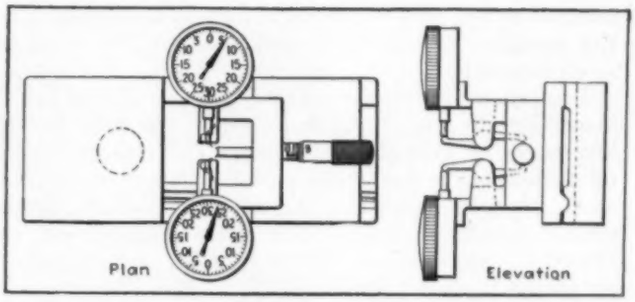


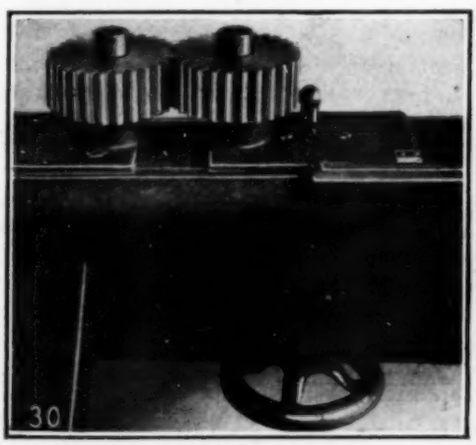
Fig. 29—Instrument for measuring a tooth profile at various points

mating profiles of an 18-tooth, 20-deg., 6-D.P. full-depth tooth pinion meshing with a 36-tooth gear. The following tabulation represents the readings on the testing machine:

Division	18-Tooth Pinion	36-Tooth Gear
1	0.	0.
2	+0.0001	−0.000
3	+0.0001	−0.0001
4	+0.0002	−0.0002
5	+0.0003	−0.0002
6	+0.0002	−0.0001
7	+0.0001	−0.0001
8	−0.0002	0.
9	−0.0020	+0.0001
10		+0.0001
11		−0.0001
12		−0.0003
13		−0.0005
14		−0.0015

For the pinion, one division on the testing machine is equal to 4.065 deg. on the chart. For the gear, one division is equal to 2.032 deg. on the chart. The figures for the pinion are written on the chart above those for the gear.

The tip of the tooth of the pinion reaches about the 32½-deg. line, or 12½ deg. above the pitch line, which is at 20 deg. As the ratio is two to one, the bottom of the active profile of the gear will therefore be 6½ deg. below the pitch line. The tip of the tooth of the gear is about 7 deg. above the pitch line so that the bottom of the active profile of the pinion will be about 14 deg. below the pitch line. Thus the active profile of the pinion covers 26½ deg. of action while that of the gear covers one-half of this amount, or 13¼ deg. One tooth



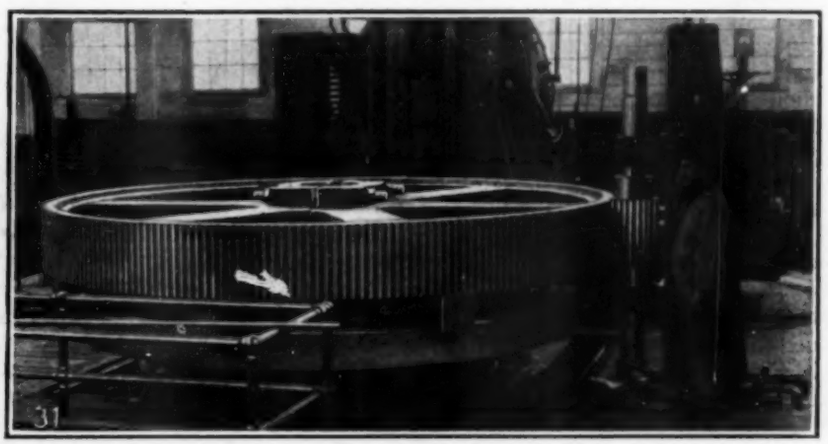


Fig. 30—Machine for making a composite test of gears. *Fig. 31—Testing a large gear with its mating pinion*

interval on the pinion is equal to 360/18 or 20 deg. Thus the duration of contact is equal to 26½/20, or 1.325 tooth intervals.

Projection apparatus, similar to that developed for the inspection of screw threads, is sometimes used for the inspection of gear-tooth profiles. The enlarged image or shadow of the gear-tooth profile is thrown on a screen and compared with an enlarged outline of the correct profile, which is drawn there. The enlargement employed is usually about 100 to 1. One type of such an apparatus is shown in Fig. 28. In this case, to avoid optical difficulties encountered in trying to get a clear and accurate shadow from a surface of considerable width, a series of needles with their points in the optical plane are pressed against the tooth profile so that the shadow of the points of these needles define the tooth outline. This method is described in detail by Ralph E. Flanders in a paper presented before the American Gear Manufacturers Association in April, 1922.

Another type of profile testing equipment is shown in Fig. 29. This instrument consists of a base with a slide that carries the gear. A micrometer head is used to locate the top of the tooth while two dial indicators are arranged with two levers to measure the tooth thickness at various heights. The gear is shifted from position to position and the readings on the dial indicators are recorded. After these measurements are taken, they are plotted as co-ordinates to an enlarged scale. This type of instrument is often used to get a record of the amount of wear on the teeth of gears. A pair of gears are measured, then placed in a testing machine and run under load for a certain length of time, then removed and measured again. The successive measurements are then plotted on the same chart, which thus shows graphically the effects of wear.

Why should gears be given composite tests?

It is not the effect of errors on individual elements of the tooth profiles that cause uneven and noisy operation so much as it is the cumulative effect of all of such errors. Such cumulative effects can only be determined by means of some composite test.

At times, an error in one element tends to compensate for the effect of an error in some other element. At other times the resultant is more nearly the sum of the individual errors. Given an infinite variety of product and infinite time and patience, it would be possible to mate up smooth running pairs regardless of the nature of the profile errors present. But this is not a satisfactory production process.

Composite tests on gears are for the purpose of measuring the smoothness of action of a pair of mating gears, regardless of the errors that may be present on the individual elements of the tooth form. The attempt should be made to establish suitable tolerances on all of the several elements so that the composite tests will also prove satisfactory. Until such tolerances are established, it will prove a very difficult task to exercise any great degree of control over the production operations.

One of the simplest composite tests that is very widely used consists of mounting a pair of mating gears at the correct center distance and of rolling them together by hand. For this purpose, several machines of similar design are on the market. Such a machine is shown in Fig. 30. These testing machines consist of a bed with one fixed spindle and one movable spindle. A scale is usually mounted on the bed that may be read to one thousandth of an inch by means of a vernier caliper carried on the sliding head. These spindles are set at a predetermined distance apart, then the pair of gears to be tested is mounted on the spindles.

Gears are tested on centers for three purposes: First, to insure that they will run at the proper center distance with suitable backlash; second, to test them for concentricity; and third, to test the smoothness of the action of the teeth.

The amount of backlash may be measured by inserting thin feeler gages between the engaging teeth or by inserting pieces of paper until the gears mesh tightly and then measuring the thickness of the paper inserted. After gears have been assembled in their mechanism, the backlash is sometimes measured by inserting a piece of lead or solder wire between the teeth and forcing it through the meshing point of the gears, thus flattening the wire. This flattened wire is then measured to determine the amount of backlash that is present. If the gears are eccentric, a varying amount of backlash will be found at different positions of the gears.

Another method of measuring the backlash is to adjust the spindles of the machine until the gears are meshed tightly together. The difference between this center distance and the correct one multiplied by twice the tangent of the pressure angle is equal to the amount of backlash.

To test the smoothness of action between the gear teeth, the gears are rolled together by hand, the driven gear being held back while the driving gear is rolled ahead. Under these conditions, the gears should roll together without any feeling of teeth; that is, they should feel the same as two plain disks rolled together. With practice, operators become very skillful in detecting improper tooth action by feel in this simple test.

Sometimes accurate master gears are provided for use on these testing machines, and the gears are tested against these masters. Again, this same type of test is also often used to select pairs of gears to run together.

The use of the testing machine shown in Fig. 30 is limited to gears of relatively small size. A similar test is sometimes given to larger gears by providing means to hold the pinion in engagement with its mating gear before this gear is removed from the gear-cutting machine. In Fig. 31, such an arrangement is shown.

Tersely Speaking About Saws

Do not use a saw that is out of round.

Metal clods can largely be avoided by lubricating the sides of the blade.

Good lubricants for a metal saw are oil, turpentine, mutton tallow, grease, or beeswax.

Use the coarser toothed blades for the softer materials, and the finer toothed blades for the harder materials.

A saw that is too thin for the work will not only produce a discordant screech, but will fail to cut true.

A saw that is burned, cracked, buckled, or clodded with metal bears evidence that the user is either negligent or incompetent.

That blades used be well adapted to the particular work is an item that should command serious and careful consideration.

Don't be stingy with saws, keep an assortment.

A smoking saw needs sharpening.

While using a circular saw be mindful always that you have but one set of fingers, duplicates are not obtainable.—From "Royle's Book About Saws."

Who Is a Foreigner?

By Entropy

JIM is a 100 per cent American. His great-great grandfather came over in the Mayflower, perhaps not the first trip, but before she was taken off the transatlantic service. He is much troubled because in order to run his shop at all he has to hire some men whose ancestors came over more recently or did not come at all. He is greatly worried over the future of these United States, but more about the future of his own shop. He says these chaps ought to be Americanized. I asked him why, if he was so sure it ought to be done, he didn't turn to and do it and not talk to me about it. "It isn't my job, the government ought to do it."

Then I asked him if he knew of any job the government was doing better than a private firm was doing it. I had him there because his wail yesterday was about government inefficiency. He had to admit that my words today were his yesterday.

"If the government can't do it as well as you can, why wait for it? Go ahead yourself."

"Say, I'd look pretty sitting down out in the shop trying to teach a bunch of Czechs and Poles and Slavs and whatnot how to read English, wouldn't I?"

I had to admit he would, for Jim doesn't look the part, not a little bit, so I told him if he wasn't competent to do the job he ought to hire a man that was, or else shut up about it. Then I went on to tell him that he evidently had the idea about Americanization that is shared by most others, which is, that all you have to give a Hunky to make a full-fledged Yankee out of him is a smattering of English.

"Suppose your shop was in England instead of here and you taught a Wop some of your style of English, would that make an American out of him?" I asked.

He admitted the force of my remark but he wanted to know what I would do with the men besides teach them English. So I told him. Sometimes you have to use very plain and simple talk to Jim before he catches on, but I think I got it across.

"Here is what we are up against. Your ancestors, if you believe the man that stung you for a family tree, came over here from England to find a place where they could do as they pleased. Part of what pleased them was to take as much land as they wanted and keep the Indians off it.

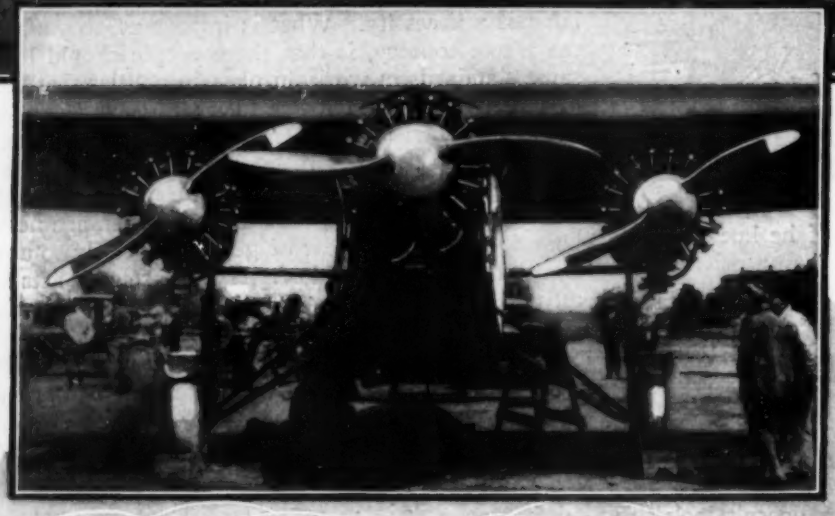
"The Indians had never built fences, they camped where they pleased, raised a little corn miles away from each other, hunted and fished. They were just plain socialists, though they did not know it. Your ancestors had no use for socialists, red or white. By force of gunpowder they made a place for themselves, and they handed down the place to posterity, which means you.

"Now, when you see some people coming over here who don't think your way, nor talk your way, you are just plain afraid they will ultimately treat you the same way your forebears did the Indians and take your property away from you. You think these men need Americanizing, by which you really mean Englishizing, because all your ancestors were English.

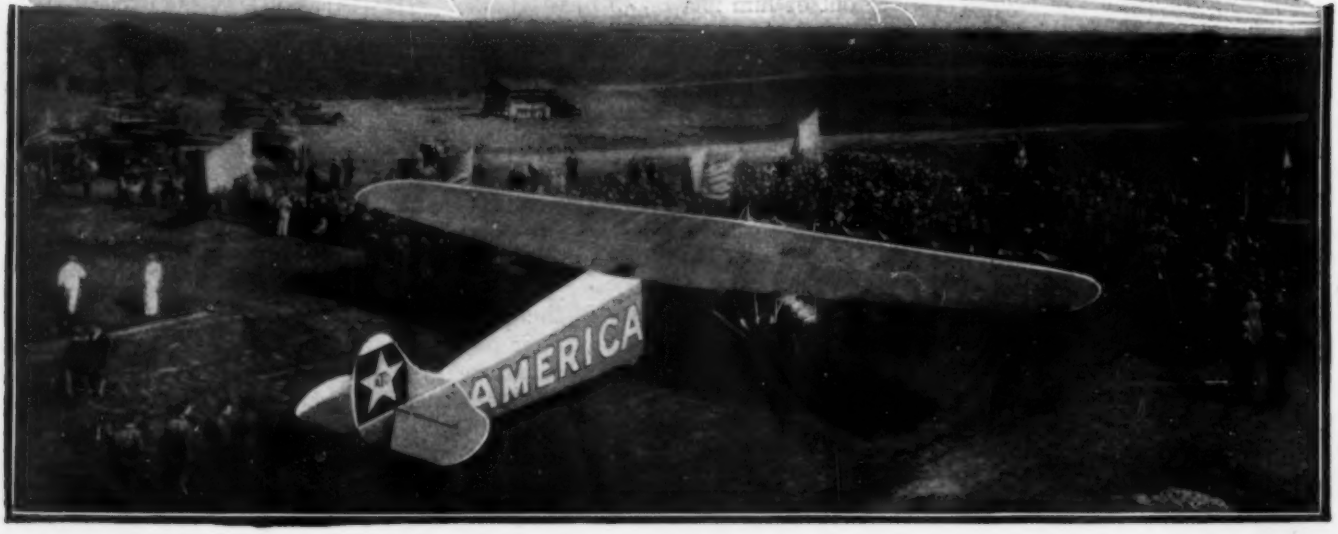
"What you ought to do is to teach these new-comers to think and act as the better educated American people think and act. Whether they speak and read English is not so important as you think. It is a convenience, but not a necessity. What is important, to you, and to the whole country, is that these people should have the same standards in work, in play, in politics that the best of us have. If we trust to luck and leave them to pick up their knowledge of America as best they can it is inevitable that they will get their knowledge from the worst possible sources. The rotten element, crooked politicians, poor workmen, dishonest workmen are never too busy to teach their ideas of getting by easily to any foreigner they can get hold of. If the foreigner acts stupid, all the better for them. He is worth laboring with because he is easily led their way.

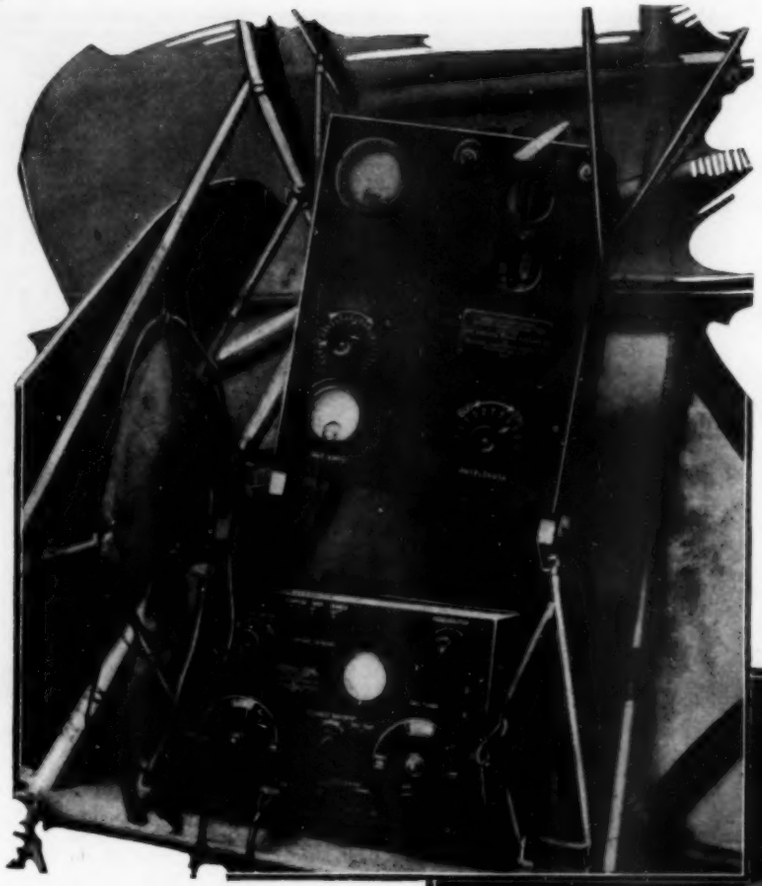
"If you don't want to see this country go to the dogs it is up to you to work somewhere near as hard as the men do who would like to undermine it. As a shop owner you want an honest day's work done, and you want the work done honestly. As an employer you are vitally interested in seeing men sent to the city halls, state capitals and to Washington who represent your ideals and not the ideals of the men to whom foreigners turn because no one else gives them a helping hand. It is not half so important to teach them English, commendable as that is, as to teach them honesty in the shop, at home and in politics. Let them see that in their own cases, and in the long run they will be better off to forget the preachings of men who only want their support for something that will hurt them as Americans. Just go out in your shop and get well enough acquainted so that you can call your man something besides 'John.' After you get that well acquainted you will find it makes the rest easy."

Crossing Two Oceans by Airplane

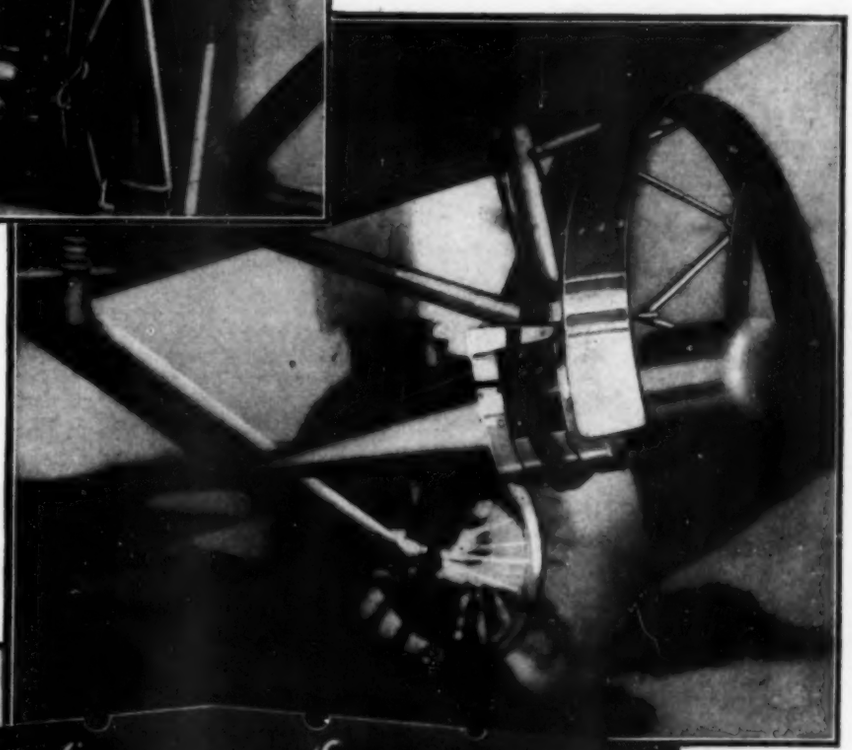


The Fokker monoplane with three Wright "Whirlwind" engines used by Commander Byrd is essentially the same plane employed by Lieutenants Maitland and Hegenberger on the Hawaii flight. Accompanying Richard E. Byrd were Bert Acosta, pilot, Lieut. George O. Noville, and Bernt Balchen



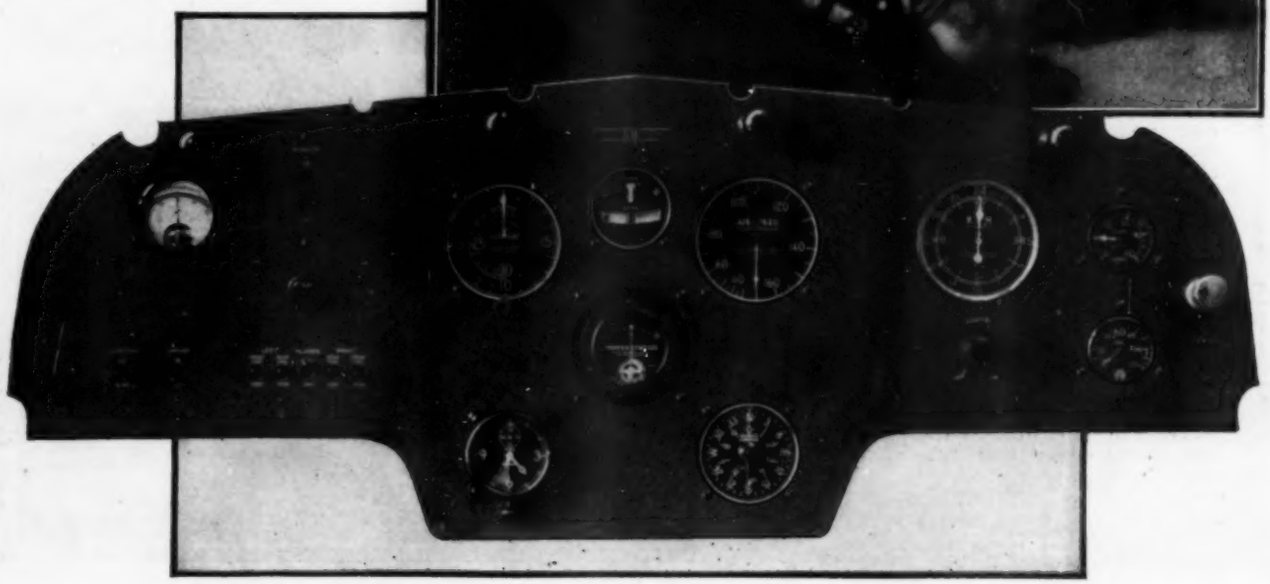


The Fokker monoplane has a wing spread of 73 ft., and a chord of 10.6 ft. It carries 3 200-hp., 9-cylinder, air-cooled, Wright engines, with mahogany propellers, a cat-walk with safety belt permits adjustment of the engines in flight. It is equipped with standard Pioneer instruments. The plane empty weighs 5,940 lb. The total weight with 4 men, 1,305 gal. of gasoline, and 60 gal. of oil was 14,761 lb. The radio transmitting and receiving sets and the air-driven radio generator are illustrated. The transmitter consists of 2 50-watt tubes in a self-rectified circuit, and the receiver has 1 stage of tuned radio frequency, detector, and 2 audio tubes. The generator is 220 volts, 400 cycles. There are 450 ft. of trailing antenna. The main wave is 690 meters, with 600 meters for distress signals



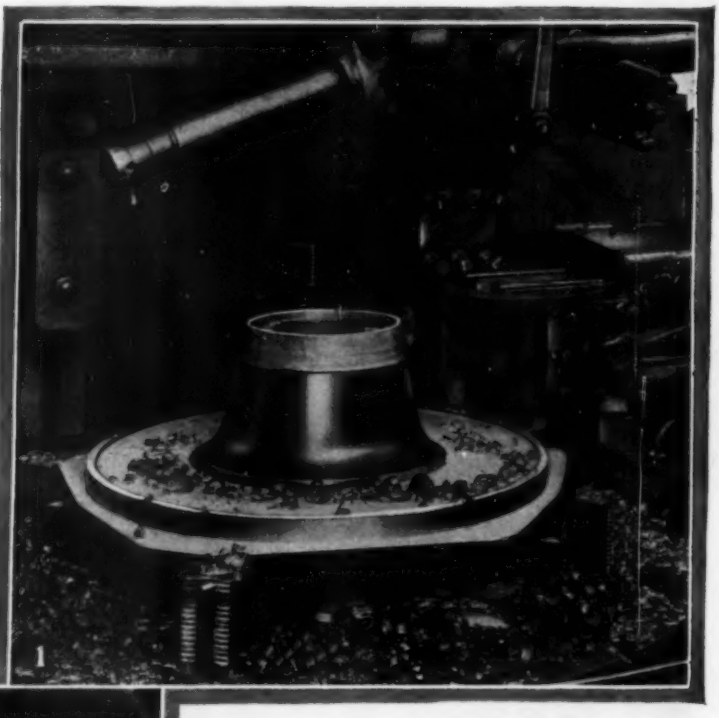
The army flyers arived at Wheeler Field, Hawaii, at 6.29 A.M., June 29, making the 2,400-mile flight from Oakland, California, in 25 hr. 50 min., completing longest non-stop sea flight, with gas left to go 800 miles farther

The America left Roosevelt Field at 5.24 A.M., June 29, and was forced down, out of fuel, a few hundred yards off Ver sur Mer, near Havre, France, after 43 hr. 21 min. in the air. The crew came ashore in their emergency collapsible boat, the plane being towed in later. Weather conditions were extremely adverse

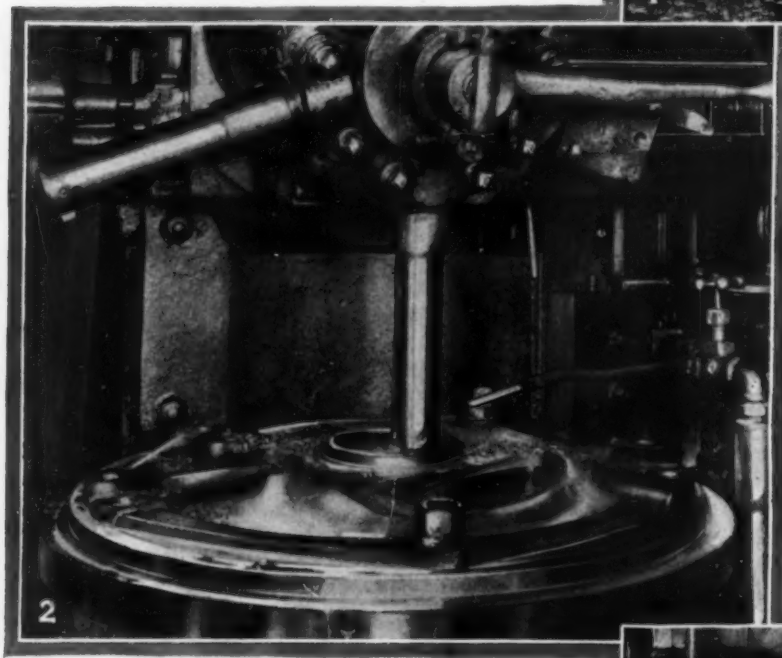


Electric Railway Motors in the making

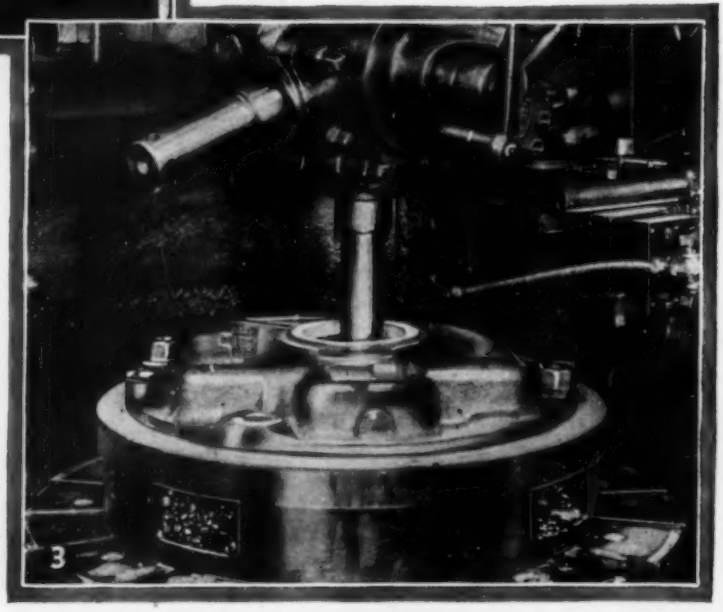
Photographs by courtesy of the General Electric Co., Schenectady, N. Y.



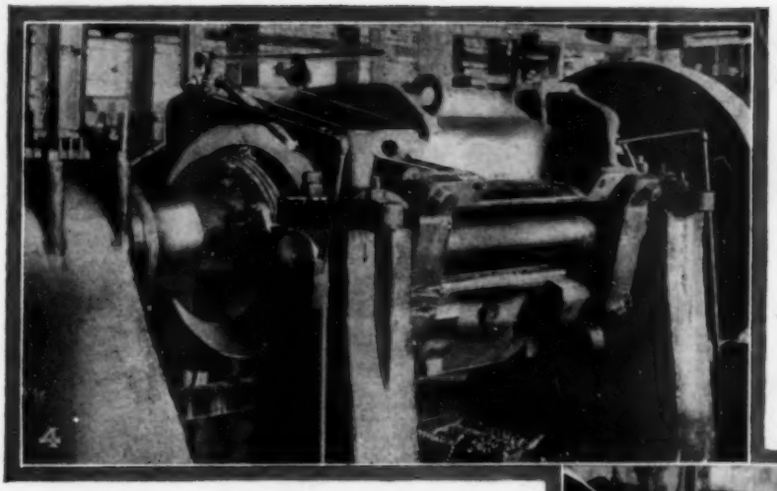
1—Turning and boring the head for a motor frame. The picture shows the first operation. Here the head is mounted on the table of a vertical boring mill equipped with a turret carrying a number of tools for the various cuts. The machine also has a side head by which turning and facing operations can be performed. Since the heads carry the bearings for the armature shaft, the work must be accurately done so that the armature will be centered in the field.



2—In the second operation the head is turned over and mounted in a special fixture on the machine table for machining the opposite side.

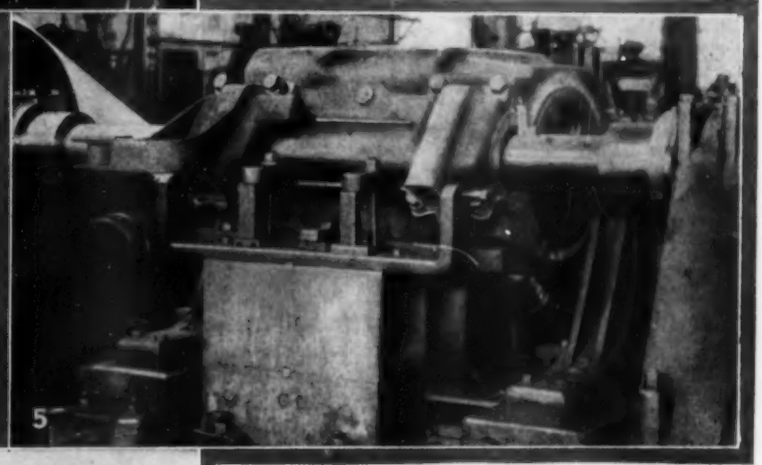


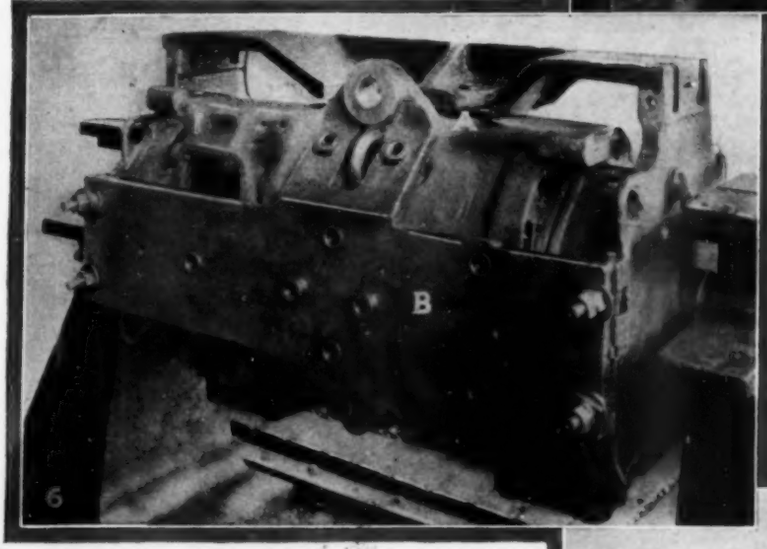
3—Finishing a frame head. The head is mounted in the fixture shown. The fixture has several openings so that the chips can easily be removed.



5—Boring and facing the outer ends of axle-bearing bosses to receive the bearings. The motor frame is supported on the lathe centers by a mandrel having heads, or large collars, that fit the seats for the end heads. The frame is clamped in position on a pedestal.

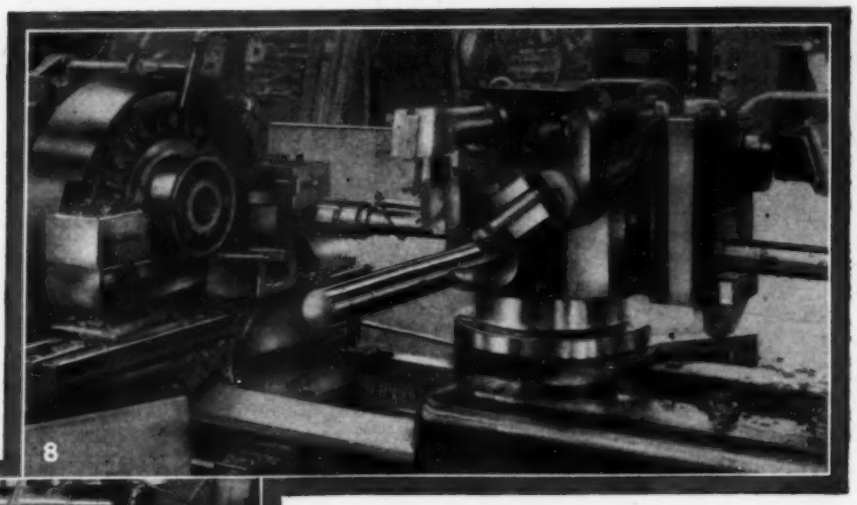
4—In machining the interior and ends of the motor frame, it is positioned on the machine carriage by a bar passing through the axle frames. The outer ends of the bar are clamped in openings at the tops of pedestals carried on the carriage of the lathe.



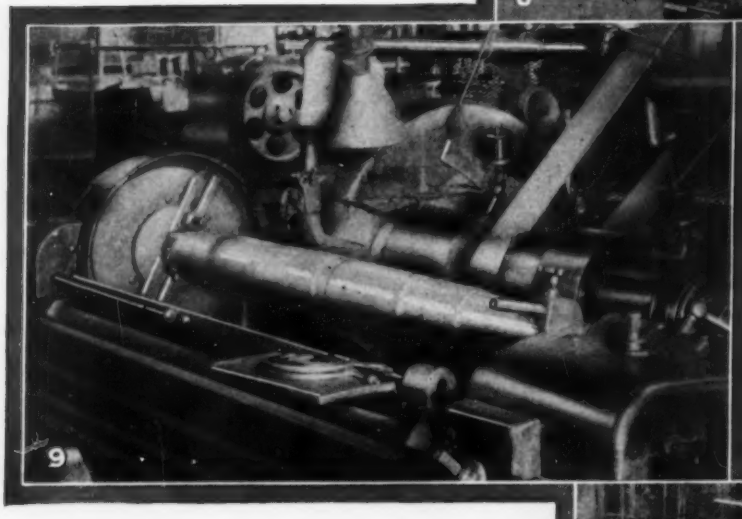


7—Another view of the jig showing the bushing plates and their fastenings more in detail. The jig is mounted on trunnions and can be indexed to bring the various bushing plates into horizontal position. The work is done in a radial drill, so that the jig does not have to be moved.

6—The jig and the bushing plates, *A* and *B*, for drilling the bolt holes in the magnet frame. The holes for attaching the main plate *B* are slotted so that swing bolts can be used for fastening it to the end pieces of the jig. The plates can be attached and removed without taking off the nuts.

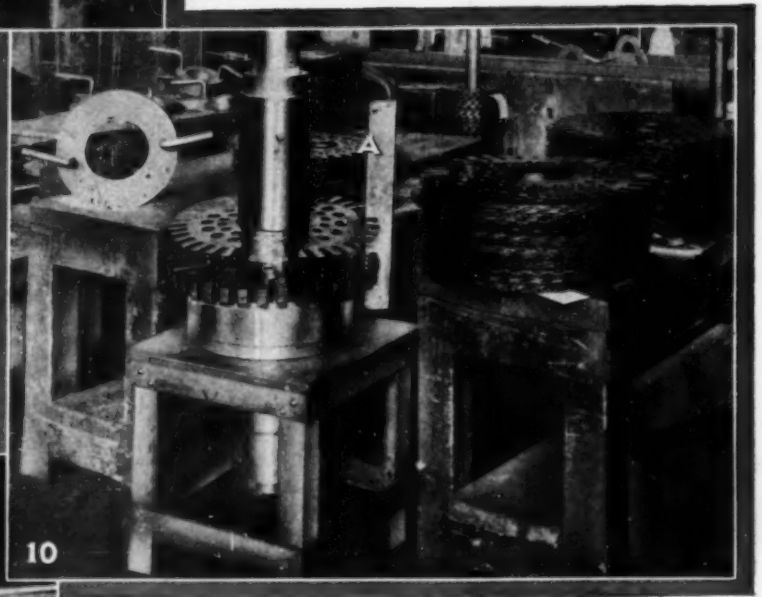


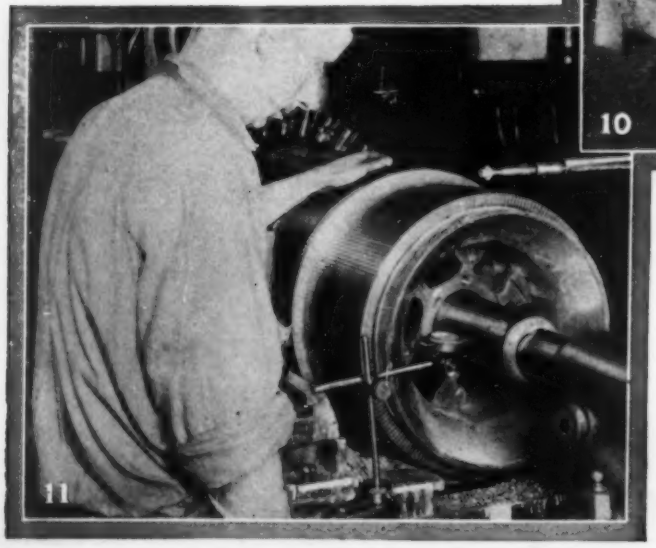
8—Turning armature heads. The work is done in a turret lathe, carrying a complete set of tools for all the operations. The tools in the turret are for boring, facing and turning, while those in the back and front toolblocks in the cross-slide are for forming and necking.



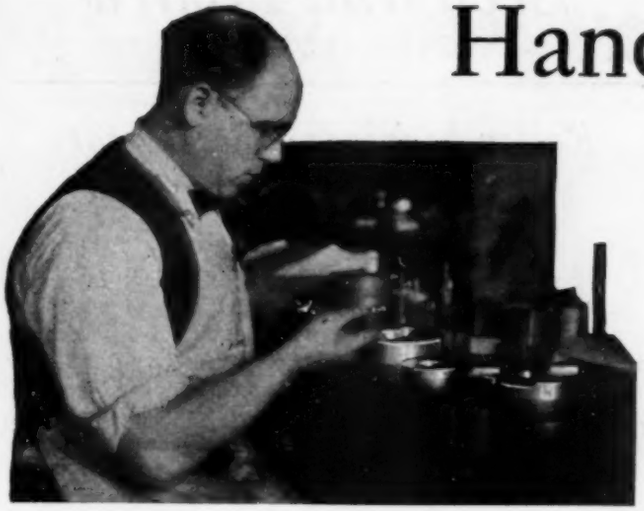
10—Stacking the core laminations. The laminations are punched from very thin stock, and must be stacked on the armature shaft, so that the notches will form continuous grooves for the winding. They are keyed to the shaft to prevent them from turning.

9—Rough-grinding the shafts for the armature. After roughing out the shafts in a lathe, using a coarse feed, they are finished to size in a cylindrical grinding machine. Grinding not only finishes the shaft more accurately to size than can be done in a lathe, but does the work more economically.





11—Final inspection of commutator and armature shaft. The commutator is built up from a number of copper bars, insulated from each other by mica. After the commutator has been turned, the mica must be trimmed so that its edges are below the faces of the commutator bars. Trimming is done by a small saw-like cutter running at high-speed. The commutator and the armature shaft must be concentric with each other.



Handling Job Work *in a Small Shop*

By Frank Waldo

An outline of the methods employed by a small shop in handling manufacturing work, including the duties of the supervisors, and the handling of clerical work

FROM the standpoint of operation, the most important factor governing the control of a job shop business is the management of the manufacturing department when there is one. To this end, it is essential to quote satisfactory prices, to construct the work correctly, and to make deliveries as specified. In order to fulfill these requirements, the managers must be both business and practical men. Some of the details of the handling of men and material in a shop employing thirty-five men are given here. The shop is that of the Quality Hardware & Machine Co., Chicago, Ill., and the product includes tools and dies along with job work. Light manufacturing work on a production basis also is carried on. The selection of men for the various classes of work depends upon their past experience and their ability as mechanics. They are paid on the hourly-rate basis. Work is distributed in accordance with the ability of the men, so that any specialized knowledge can be utilized profitably.

Centering the Responsibility

In allotting tool and die work, the practice is to have one man complete the order with the exception of planing and grinding, both of which are handled by specialists. By this method, a man takes a greater interest in his work because he is held responsible for construction and assembly, as well as for part of the machining. Time is saved by making explanations to a number of men unnecessary, and another advantage is the reduction in cost. For example, if some misalignment is discovered in the making of a part, it is often possible to rectify the error by altering its adjacent assembled parts accordingly, whereas if the work is distributed to several men, the parts might be completed beyond this stage and require reconstruction. Larger jobs, and work that is wanted in a hurry, are handled by two or more men, but the same policy is carried out, in that one man is given control of the job.

The tool and the manufacturing departments are separate so as to avoid the confusion that would occur when a toolmaker wanted to use a machine that was engaged on a production job. Experience in this direction has shown that considerable time is saved by handling each class of work separately. Men from the tool department are transferred temporarily to the production department when additional assistance is needed, or when tool work runs low, so that a uniform force may be maintained. This policy often avoids temporary layoffs, and enables the company to maintain a well-balanced force with small labor turnover.

Both classes of work are supervised by the superintendent and an assistant. The duties of the superintendent include estimating, supervision of tool design, ordering of materials, distribution of the work, and general observation of the progress of each job going through the shop. The assistant superintendent follows the progress of the work in detail and, in addition, handles whatever heat-treating is required, inspects the work as it progresses and in its completed condition, and fills in his time by handling overflow work, or by assisting in the construction of a tool that is wanted in a hurry.

Each order going through the shop is given a number that is carried until completion of the job. Likewise, what material is required is charged to that number, so that the labor and material costs can be checked readily. When an order is placed for a tool or a die, the original estimated figures, including the material to be used and the subdivided operations such as layout, machining, bench and assembly work, are listed on a cost sheet that is filed by number. Then, as the work progresses, the actual time consumed for each operation is recorded on the same sheet. These records offer a comparison at all times, inasmuch as the figures are recorded daily. If a job is falling behind the original estimate, an immediate investigation is made by the superintendent to determine the cause. When a job has been completed, it is comparatively easy to determine the profit or loss, as the case may be, by examining the comparative figures.

Dual Card Control

The workmen record their time on two cards by a time clock. One card is the weekly time card, punched each morning and evening, from which the payroll is made; the other card is the job card from which the actual time cost of each order is obtained. The job cards, of which one is required for each order number, are divided into fourteen intervals of time. On the card are provisions for the date, the "begin" and the "stop" times, and the elapsed time. If a job consumes more than the fourteen working periods provided for, a new card bearing the same order number is made out. The time records of each job are entered on the cost sheet

by a timekeeper who also attends to the payroll and miscellaneous office duties.

An attempt is made to carry in stock raw materials in sizes usually required. Cold-rolled steel in rounds up to 2 in. in diameter, and in flats up to 1x6 in.; drill rod in sizes up to 1 in.; and miscellaneous sizes of steel and brass rod, tubing and flats, are stored in a rack at the rear of the shop. A power saw is located adjacent to the rack, so that specified lengths can be cut off as required. Each workman cuts his own material. Small scrap ends and miscellaneous pieces left over from short bars, are kept in a separate bin so that a man in need of some odd piece can occasionally find the material he wants without cutting it from a bar.

Toolcrib System

Small tools, kept in a crib, are obtained by the men as needed. Racks and miscellaneous stands are provided in the crib for the different sized tools, such as drills and taps and dies, each size being stamped in the position the tool occupies in the rack. When a man has finished with a tool he returns it to the crib, thus avoiding the necessity of a toolcrib attendant. Tap and die sets, including a tap drill, a full-size and a clearance drill, a bottoming and a plug tap, a counterbore, and a die, are mounted in steel blocks, so that they can be taken out as units. Precision tools, such as micrometers, depth gages and squares, are kept in a steel cabinet, and are issued only with the approval of the superintendent or his assistant.

In handling die work, the first procedure is to lay out the proposed operations and the tools required. In certain cases, the designs are submitted to the customer for approval before work is commenced. Experimental work, such as the checking of drawing operations, is developed by the use of test dies. This procedure is necessary in handling dies for a drawn shell in which the thickness of the material must be uniform throughout. In constructing dies of a simple nature, the procedure is to lay out the general design roughly so that the toolmaker can determine the scale dimensions to use in making the various parts. In building dies of a more complicated nature, when designs are not furnished, a detailed layout is made so that the toolmaker can more easily follow the exact requirements.

Special Tools Ordered

The majority of dies are fitted to standard die sets, purchased in the finished state. If an unusual type of die is required, the die set is ordered from a manufacturer specializing in this class of work. If their size permits, dies are tested before being shipped to the customer. In general, the same procedure is followed for the construction of jigs and fixtures.

In handling production work the parts are run through in quantity lots, so that the set-up time will be reduced and so that a lower cost per piece can be established. The nature of the product generally controls the method of manufacture, but the general practice is to make a number of parts first and assemble them later. Jigs and fixtures are designed in accordance with the amount of production required. For example, assembling fixtures, made of hardwood, are used when the quantity is small; whereas more substantial tools are made for work produced in larger quantities. Castings and forgings are made by outside concerns since no facilities are available for such work, but crating and shipping are handled at the shop whenever demanded.

Seen and Heard

By John R. Godfrey

Roller bearings—Steel gears —Unskilled men

ONE of the signs of change in machine-tool construction is the growing use of ball or roller bearings on the spindles, as well as on intermediate shafts. Those of us who, while agreed that the anti-friction bearings were good things on auxiliary shafts but would not equal the good old solid bearing for spindles, will have to revise our opinions or join the non-progressives who insist that a thing can't be done—after it is here.

This view is strengthened by a recent specification sheet of a concern that was in the market for a lot of machinery. The most important item referred to spindles and stated that spindles with a certain roller bearing would be given preference. In this particular shop these bearings have been used on spindles for several years, with great success. Hence the preference shown by the specification.

* * * *

These same specifications had several other points of unusual interest, one being that all gears in gear trains that could be called vital, must be of heat-treated steel. No others would be considered. Here again the experience of the shop has been that the thing specified had proved good. And after all it is experience that counts.

There are doubtless many places where pressure is low and speeds moderate, where cast-iron gears are perfectly satisfactory. But the tendency of users of high-production machinery is toward the use of steel gears, heat-treated, to avoid the possibility of breakage that would tie up production. For it frequently happens that delay in producing a comparatively insignificant part may delay the shipment of a ten-thousand-dollar machine and we can afford to pay real money to avoid delays of this kind.

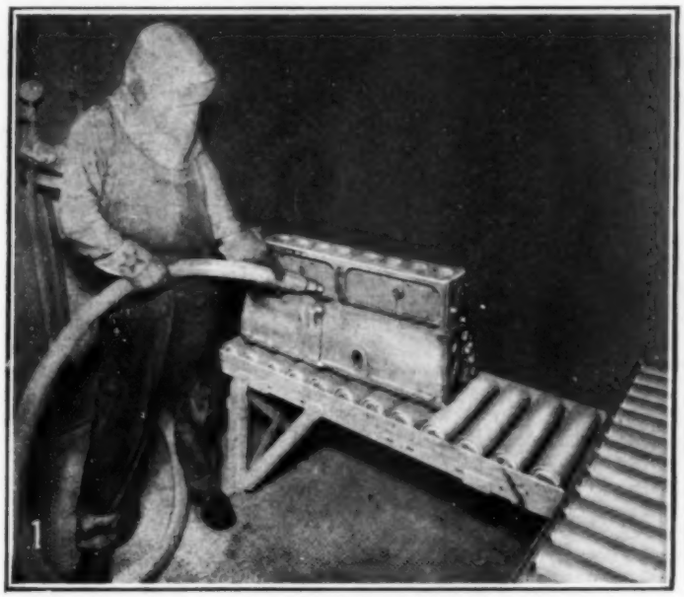
* * * *

"Forty jobs waiting for skilled men—fifty unskilled men outside waiting for jobs"—said an employment manager the other day in a large industrial city. This condition is one of the great problems of unemployment. Machinery, instead of eliminating the need for skill, demands perhaps, another sort of training, but more of it. And as before, the unskilled make up the great army of unemployed in most places.

Some cities are recognizing this and are providing for giving the kinds of training needed in that locality. Men who are not satisfied with their kind of work, can receive the elements of other trades in the evenings, and so prepare for other kinds of work. And opportunities are being made for men who are ambitious enough to study, to fit themselves for better work.

A city that strives to aid in giving its workers the opportunity to find congenial employment, is bound to attract the most desirable class of men to become its citizens. Such cities are building the foundation for true prosperity.

Automotive Production



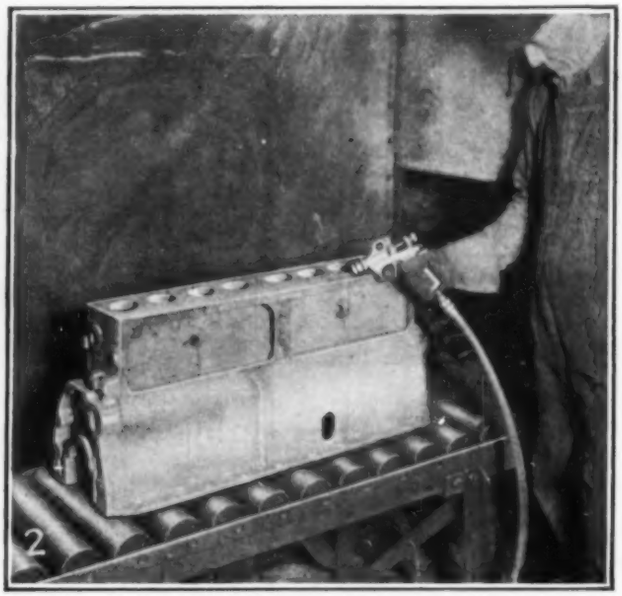


Fig. 1—Sand-blasting the cylinder block. Fig. 2—Spraying with Duco "sealer"

The Marmon "8"

By Fred H. Colvin
Editor American Machinist

A compact and efficient shop layout for securing quantity and quality of product at a reasonable cost—Fixtures and methods in machining cylinder blocks and cylinder heads

BRINGING out a new model automobile in these days of large-volume production means much more than formerly. The selection of the proper machine equipment, and its arrangement so as to permit continuous travel of unit parts, and then to tie them into the assembly line at the proper point, are of major importance. The saving of floor space as well as of time and labor, all have to be reckoned with in these days of keen competition. Considering these various points, the layout of plant No. 3 of the Marmon Motor Car Co., Indianapolis, will prove of interest to all engaged in quantity production.

Plant No. 3 consists of two buildings, *A* Fig. 3, 80x600 ft., and *B*, 100x800 ft., joined at *C* by what is practically an L on building *A*. As can be seen from the floor plan, the material starts from the right-hand end of building *A* and flows to the left through the different departments—flywheel housing—crankcase and cylinder—bearing cap and valve tappet guide—connecting rod—rocker arm and bracket—manifold—cylinder head, etc.

The parts flow into the engine assembly line, which is at right angles, so that each part reaches the assembly in the order required. This is why the cylinder head department is so far separated from the cylinder department. From the end of the assembly line, the completed engines go to the test room and come out after the chassis have been Duco sprayed for the last time.

In the meantime, the frames are being assembled at *D* and grow into chassis at *E*, where, after being sprayed on the under side, they are rolled over automatically onto the final assembly line which is parallel with the first machining lines, and leads out of the long building at the other end. The layout is compact and consequently eliminates much handling of material. It is flexible, in that production of each part can be governed to suit the desired output, and no part of the production line interferes with any other.

The first shop operation on the cylinder block is to sand-blast it, as in Fig. 1, in a room built for the purpose. The rolling conveyor aids in ease of handling the

Automotive Production

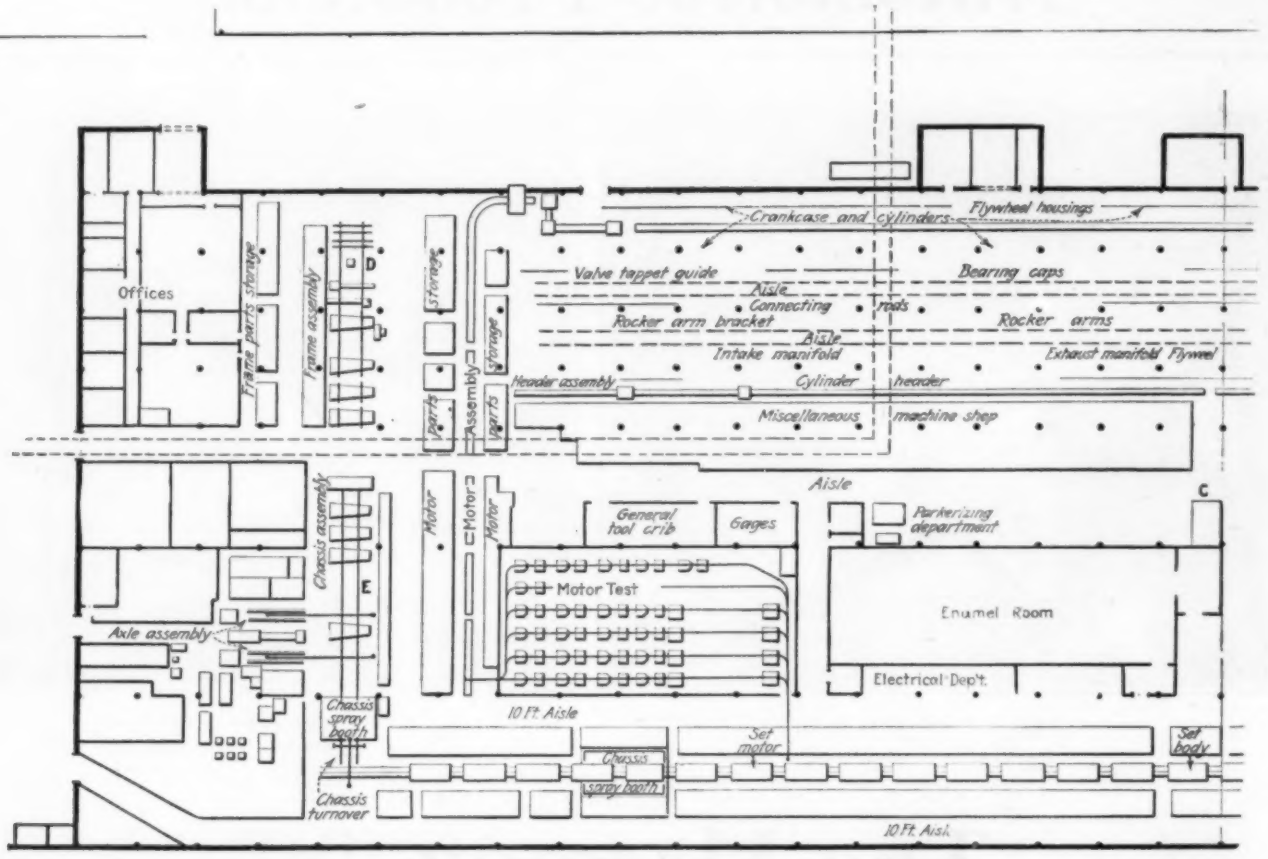
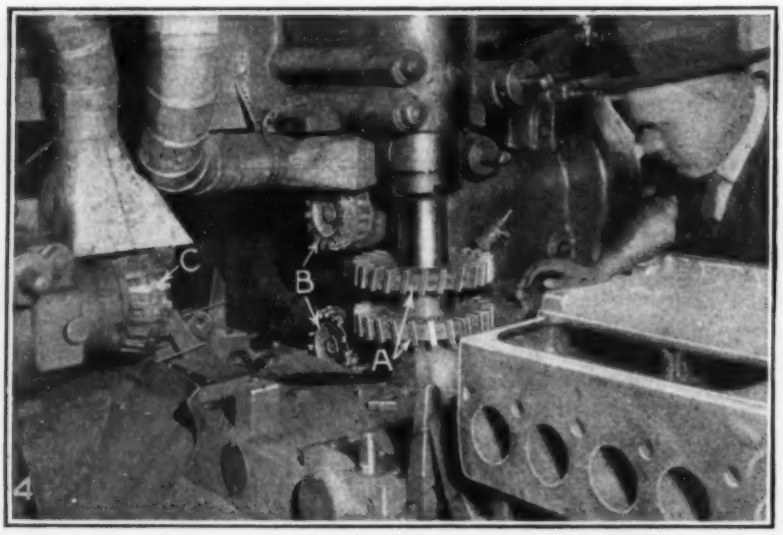


Fig. 3—Plan of shop layout. The shop has an area of

block while being sanded, and also starts the block on its way into the shop. Next comes the spraying of the block with Duco, both as a "sealer" against minute porosity in the casting, and to make it more agreeable to handle in the machining operations. The operation is shown in Fig. 2, where the exhaust fan carries the fumes away from the operator and his fellows.

The rough milling set-up is shown in Fig. 4. Here cutters *A* rough out the seats for the bearing caps; cutters *B* surface the bottom; and cutter *C* surfaces the top to receive the cylinder head. The machine is an Ingersoll, and the fixture is designed to position the block so as to equalize the cuts and to handle and clamp it easily. The finish milling of the block is done with the cutter set-up shown in Fig. 5, minus the cylinder block in order to show the cutters. Cutter *A* finishes the cylinder-head joint surface, cutter *B* finishes the oil pan joint; cutter *C* finishes the bearing lock; and cutter *D* mills the side



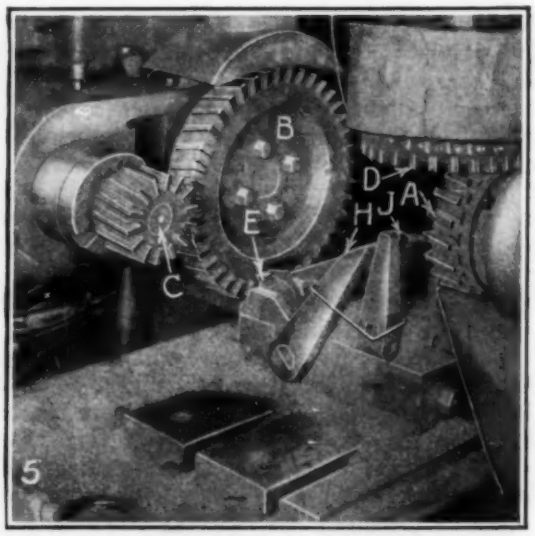


Fig. 4—Cutters for rough milling. Fig. 5—The finish milling cut

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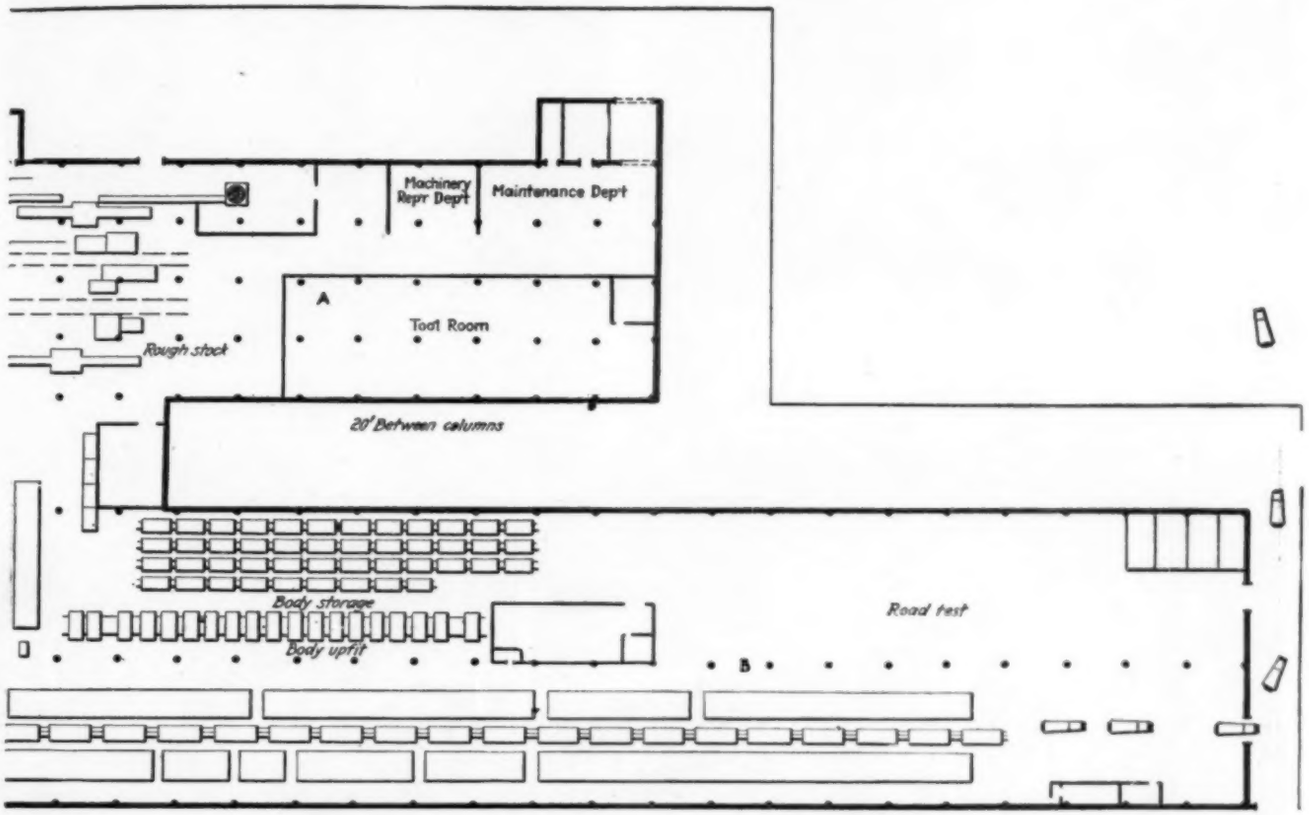

128,000 square feet and is arranged for progressive assembly

for the valve cover plate. In both Figs. 4 and 5, attention should be given to the provisions made for exhausting the fine cast-iron dust arising from the cutters.

A good example of the way cutters are laid out for work of this kind is shown in Fig. 6, which is a schematic diagram both for cutters and the gears by which they are driven. The roughing cutters are shown at the right and the finishing cutters at the left. The pair of straddle mills are mounted on a vertical spindle, as in Fig. 4, but are shown in a horizontal plane to avoid making another drawing.

The cylinder milling fixture is shown in outline in Fig. 7. The cylinder block rests on hardened steel plugs, some of which are adjustable, as at *E*, in Figs. 5 and 7. The block is positioned endwise by the arm *H*, in Figs. 5 and 7, which can be swung down and out of the way after the block has been clamped. There are pull-down clamps at each end as at *J*, Figs. 5 and 7. Plugs *E* are adjusted by the cam *K*, Fig. 7, while clamps *J* are operated by the combined cam and lever arrangement shown in detail at *L*. Each end of the block carries a clamp of this type. Cylinders are bored on the horizontal, Foote-Burt machine in Fig. 8, in which the cylinder block has been removed so as to show the supports for the outer ends of the boring bars. In this way both ends of the bars are supported at all points of the cut so as to assure alignment and roundness of bore within very close limits. A conveyor brings the block to the machine, and the fixture clamps are easily operated by the handles shown.

Line bearings are bored in the heavy fixture in Fig. 9, in a Rockford machine. The fixture is double, so as to permit loading one side while a block in the other side is being bored. The bushings in the fixture are cut away to permit the fly cutters to pass through, indicating the extent to which the fly cutter has come into use. The block is located by dowels in the usual manner and is

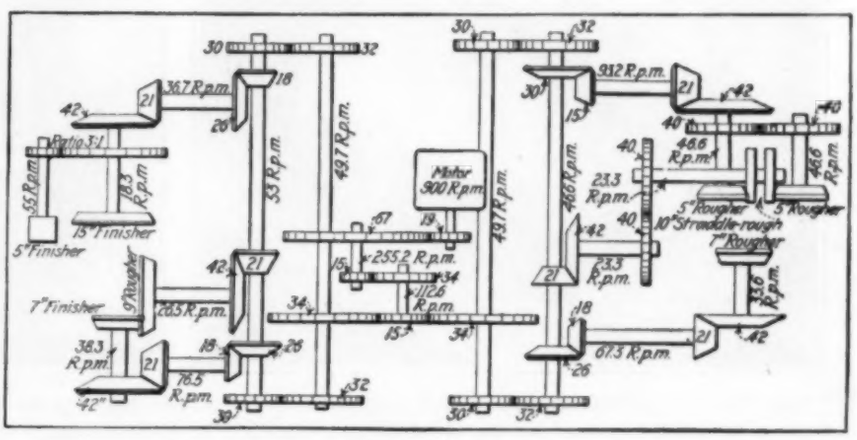

Fig. 6—Schematic diagram of cutters

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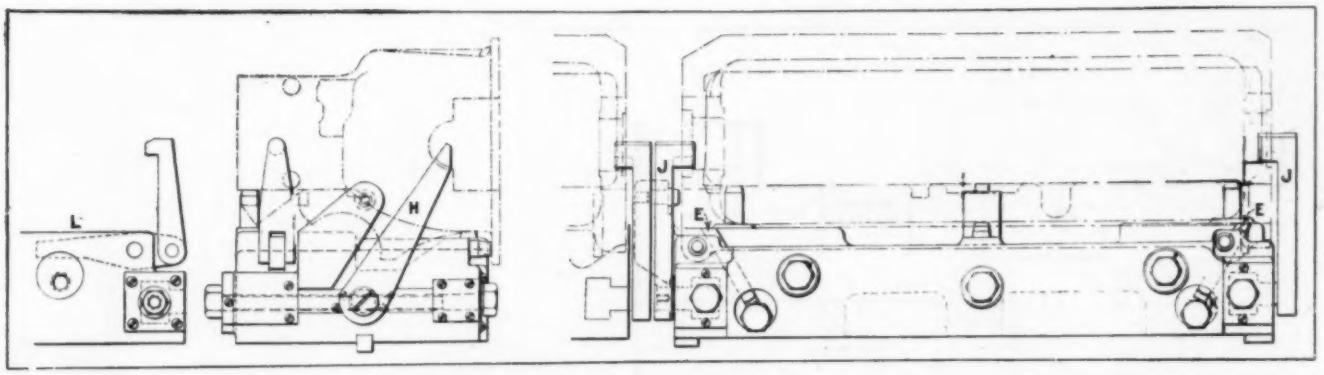
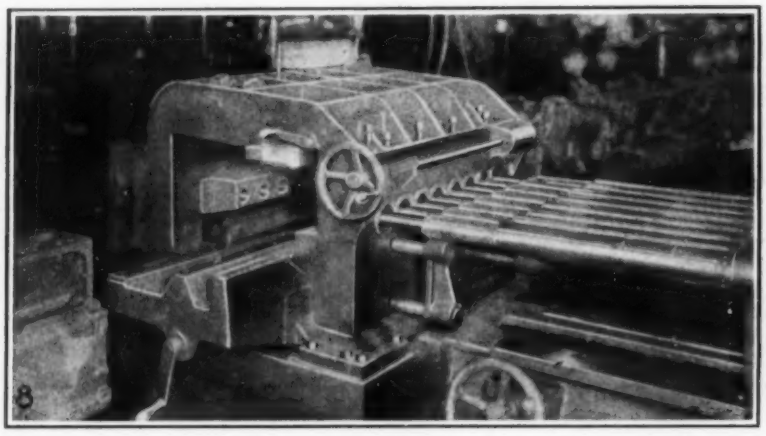


Fig. 7—Details of milling fixture



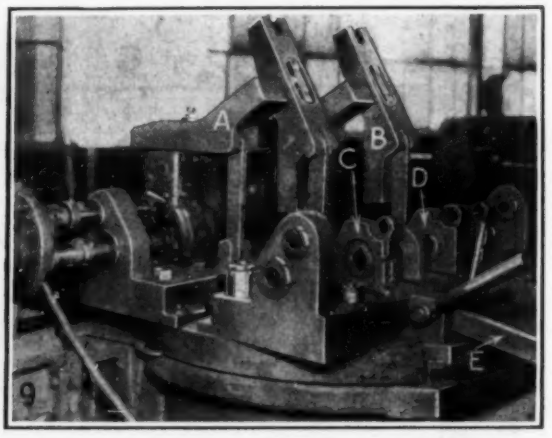
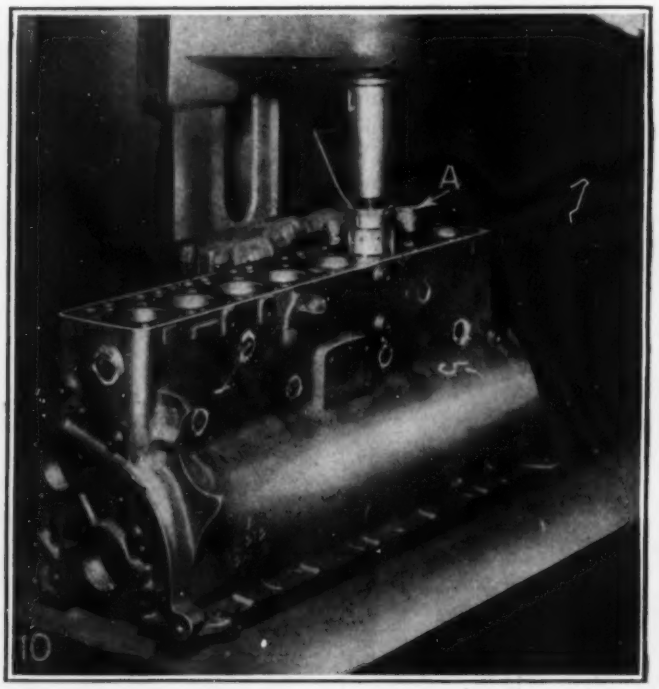


Fig. 8—Machine for boring cylinders. The cylinder block has been removed so as to show the supports for the outer ends of the boring bars. Fig. 9—Fixture for crank- and camshaft bores



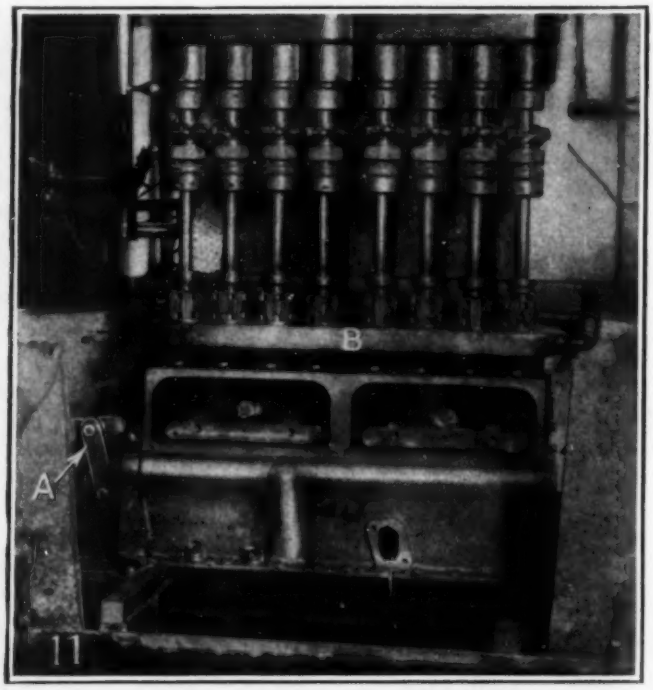


Fig. 10—The cylinders are reamed singly with one reamer, making the holes uniform in size. Fig. 11—Honing the cylinders in a machine having hydraulic feed. The cylinder block is held by quick-acting clamps. The guide plate is in the form of a shallow pan and carries kerosene with which the hones are lubricated

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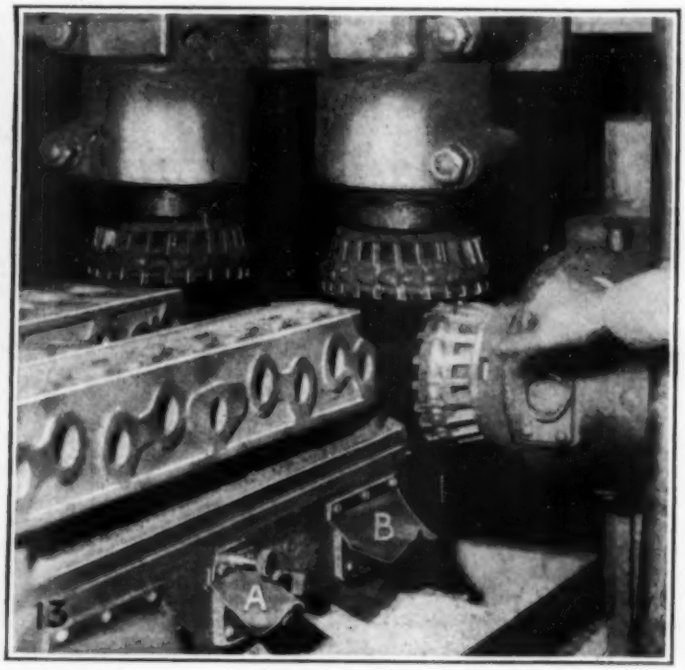


Fig. 12—Inspecting bores over a lighted table. Fig. 13—Milling cylinder heads

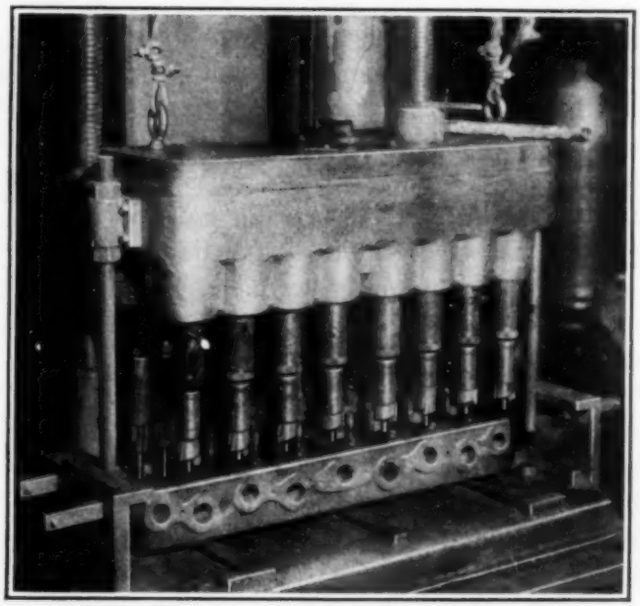


Fig. 14—Special head for drilling and facing valve seats

held by the counterweighted clamps at the top, *A* and *B*. The substantial center guide-blocks, as at *C* and *D*, show the care taken to guide the boring bars to insure alignment. The clamping link *E* swings down out of the way for loading and unloading.

Cylinder bores are reamed singly instead of all at once, so that the same reamer can be used in them all. In this way there is only the wear of the reamer in use in eight holes to contend with, and greater uniformity is secured for honing and for the selection of pistons as well. The machine is a Foote-Burt, heavy-duty type with steel rails on the table and a quick acting clamp that goes on each side of the reamer, as can be seen in Fig. 10 at *A*.

Honing is done on one of the new Barnes, hydraulic-feed honing machines, as in Fig. 11, using a Hutto hone. One of the quick-acting clamps is shown at *A*. It will be noted that the guide plate *B* carries kerosene as a lubricant for the hones. Before passing to the assembly line, each bore is carefully inspected, as in Fig. 12. To aid in examining the bores, the block slides on the bench *A*, at the end of the conveyor line. The center of this bench is cut away and beneath it are powerful electric lamps that illuminate the interior of each bore so that its exact condition can be seen almost at a glance.

Cylinder heads are milled in much the same way as the blocks, as in Fig. 13. By using two fixtures and reversing one block each time, three sides are milled at once. A feature of the fixture is the way in which the clamping-screw heads are covered, as at *A* and *B*. The cover is flexible and is easily raised to apply the wrench, yet it keeps the chips away from the screws and prevents them from working into the bearing surfaces.

A combination operation is shown in Fig. 14, where holes are being drilled and the valves seated at the same time. The machine is a Baker heavy-duty, fitted with a special drilling head designed and built for the job.

According to an authority on internal combustion engines, the governing factor in the endurance of an engine in continuous running is the life of the valve springs. Just what the life may be before fatigue becomes failure, seems to be unknown. Taking the Lindbergh flight of nearly 34 hr. and the endurance flight of Chamberlin and Acosta of over 51 hr., there were anywhere from 1½ to 3 million openings and closings of the valves, and without a spring failure. This record speaks volumes for the quality of steel used in valve springs, and emphasizes the fact that any mechanical achievement depends almost entirely on one or many of the small details that we are very apt entirely to overlook.

THE · FOREMAN'S · ROUND · TABLE

Keeping Down the Work in Process

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"JINKS, Al! What's this dope that Williams is getting off about keeping down the work between machines. Says he wants the foremen to keep as close to zero inventory as possible.

"You know all our production workers are on bonus or piece work, Al, and they like to have a good batch of work ahead of their machines so's to prevent any waits when the preceding operation is tied up. They won't like this new scheme, I'm thinking."

"Good argument, Ed, you're improving, but you can bet Williams has thought of that. He was filling me up with the thing, too, and it looks pretty good to me.

"You see, we carry a whale of an inventory of parts coming through the production jobs. Williams says those gear assemblies alone average forty dollars apiece, and we sometimes have batches of a hundred at a time. That's four thousand iron-men at one whack. And the small stuff is a bad problem, too. Seems to me there's no need for the men to have a big box of parts at each operation. Just because we get a bunch of castings from the foundry doesn't mean we have to put costly work on all of them."

"But gosh, Al, I've done some figuring myself, and even if we cut down the inventory twenty-five thousand dollars, that's only about a hundred a month interest on bonds, and it wouldn't pay for a good follow-up man to keep the stock moving."

"Righto, Ed, but time comes in, too. Takes three months for some of our work to pass through the shop, and that makes it difficult to incorporate changes, especially when there's a lot of work between operations."

"Maybe I'm a dumbbell, Al, but this is getting past me. Why don't the time-study man let us know how many pieces to start at one time, and how many to keep between operations?"

"That's the stuff, Ed, you're certainly getting peppy ideas since your vacation. The time-study man ought to be able to get a bird's-eye view of the whole business, as he studies costs in all the departments, and knows where delays occur, too. Let's go see Williams and fight it out with him."

Where is the zero point in stock inventory?
Does it pay to reduce work in process and add follow-up men?
Who can best determine economic work-in-process requirements?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Arguing with the Big Boss

MANY years ago, when a young man at the lathe, the Big Boss came over with two pieces of brass sweated together and a sketch, instructing me to get ahead with this core-box at once, and to work overtime until it was finished. A few minutes later I noted that the box was wrongly drawn in relation to the parting line, and if machined in this way would be useless, as parting the box would also pull the core to bits. I immediately drew the foreman's attention to it, but being one of the type who if anyone interfered with his work, left it alone, he said "see him, it's his job not mine." On interviewing the Big Boss he was greatly annoyed at my presumption, refused to hear any explanation, and promptly told me "there is the sketch, go and work to it." Getting back to my lathe I considered whether to chuck his job according to sketch or "chuck" my job. The latter seemed the most honorable, and being after the usual stopping time, I told the foreman that I was finished. After my evening walk I found a letter from the Big Boss, instructing me to report at work in the morning as usual. The way the foreman had explained matters after I had left, made the Big Boss take another look at his sketch, and seeing his blunder, had at once sent the letter. Next morning he apologized, complimenting me for knowing far more about drawings and core-boxes than he had thought. A fortnight later I was promoted to assistant foreman.

Since that time many arguments have occurred with various Big Bosses, but a word of caution is necessary. Never argue with the Big Boss unless you are confident that you are right, then you can go ahead.

—F. P. TERRY, *Ireland.*

THE more any foreman realizes that time saved is money gained, the greater the chance of prosperity for all concerned. Al evidently knew that apart from any reduction in wages, there was the prospect of an increased output with a proportionate decrease in his overhead expense rates. Again, the shirking of responsibility by following instructions blindly cannot but be harmful to anyone's mental, and eventually, material position. For his own satisfaction any man, unless curiously lacking in assertiveness, must speak his mind if he feels himself sure of the facts. Having done so, he will of course be bound by the decision of his superiors, and should accept it loyally. Whatever sins a foreman may be credited with, lack of assertiveness is seldom one of them.

Certainly a foreman should not plan work uneconomically in order to keep a new machine engaged. The justification for an increase in plant is the reduction in cost. It is better to have a machine standing idle than for it to be consuming power and all the other operating expenses for a longer period than necessary.

T. H. HARGRAVE, *England.*

THE : NEXT : TOPIC

Abolishing Private "Mikes"

QUESTIONS

Should the company supply all measuring instruments? How should they be handled? What are the reasons for and against?

Should the Shop Govern Purchases?

THE purchasing of material must be made by the purchasing department with the advice of the shop superintendent on the quality and performance that will be required of the material. It is evident that the man who uses the material has the better opportunity to judge its quality. If quality is not a factor the shop does not enter into the transaction. However, there are very few purchases made where quality of the material may be disregarded. The shop man must be unbiased in his judgment of quality. It is not good business to buy a material too good for the job. Sometimes the purchasing agent is justly discouraged by the logic of the arguments given by the shop man in favor of a certain brand of material. A vague reason for using a certain brand will not satisfy a real live wire purchasing agent. In Ed's case the purchasing agent was wrong in buying the brass without knowing definitely if the same results could be obtained. If Ed could not have advised him without a trial surely a trial would have been less expensive than the method used. The seller should give technical service without charge. His service should have been in this case to show Ed that although his brass was cheaper the same results could possibly be obtained by changing the shape of the forming edges on his dies. The practical selling man, the purchasing agent, and the shop man are all necessary to good purchasing. There is no mystery about the performance of any material, and if one grade is inferior to another the shop man must show the difference clearly and the others work accordingly.

—CHARLES H. GODSCHALL.

Applying the Budget to Small Tools

DESPITE all the apparent advantages, I fear that budgeting small tools will tend to limit production, particularly where the men are on a daily wage basis. No matter what the cause, or how far remote from the plant its origin, every grouch developed by a mechanic will inevitably settle on the fact that you can't expect a man to work without tools. It may be illogical, it may be unjustified, but the more unreasonable it is, the more impossible it will be to convince the author of the grouch that he is unfair in his kick. He'll take extreme delight

in hunting up the foreman to register his kick, meanwhile losing valuable time from production. And when a man stops producing you not only lose the cost of his time, but the investment in the machine he is working on, the overhead on his job, and many more indirect changes.

So, while it will bring about greater care of tools, I would hesitate to recommend budgeting. Rather, through my foreman I would make appeal to the men to take good care of the tools, trying to explain their relationship to overhead and eventually to their own wages.

—GEORGE NEILL.

LOSSES due to the inauguration of a tool budget system will cover a wide scope compared with a paltry saving on tool costs. If a mechanic is issued a certain amount of drills as his quota for the day, and he has a job that requires considerable drilling, what will he do when his quota is exhausted? He will invariably finish the day by loafing around his job rather than ask for additional drills under the existing circumstances. It becomes apparent then, that under such conditions, a "tool budget," though beneficial in the sense of tool economy, is detrimental to production. —PETER HAGEN.

IN APPLYING a budget to small tools, the men should be told of the plan, and it should be up to them to make a good showing for their department with a possible reward for staying within the allowance. The men should be told that production is still the prime issue, and that no tool should be babied along for the sake of saving it. Each man should also be asked his opinion regarding the quality of tools provided. Enough tools should be available so that a damaged one can be set aside immediately and replaced by a new one.

—J. C. P. BODE.

A BUDGET to reduce the amount of small tools used should not hinder production in any way. The efficient method will specify the amount of small tools that will be allowed by the budget, but will not mention that no more than this amount will be available for the period. Many organizations that budget have found at certain times that the allowances made were not large enough, and at other times too large.

The budget will tend to decrease the amount of small tools used, and it will act as an incentive for the foreman to make sure that the utmost service has been secured from the tools before issuing new ones to replace them. —B. C. THOMAS.

Getting Information from Salesmen

THE salesman who is an expert in his own line, and who has good engineering experience, is generally welcomed by the management of any go-ahead shop. Of course, one is not always buying machinery, but a chat on the latest practice never comes amiss, especially if some idea discussed can be applied usefully in the shop later on. These visits are useful to the salesman, because if he does not make a sale, he is preparing the ground for the future. Such salesmen are few and far between, and "that fellow Timmons" seems to be one of the sort to encourage.

Al's remark with regard to help from all sources shows a keenness to obtain all the knowledge possible about his job. When a foreman begins to realize that he does not know it all and does not object to obtaining information from odd sources he is beginning to fill his niche in the shop scheme properly.

—T. GEE, *England*.

Should the Foreman Get a Bonus?

IF THE foreman is on straight salary and his men on piece work, their average earnings would often exceed his own, which is not fair to the man in charge. A bonus would stimulate and maintain the foreman's interest. If all work is inspected before bonus is paid, it would prevent abuse of the system. If you make a foreman's position attractive you will always have men in the shop striving to make themselves worthy of promotion when vacancies occur, thus it makes for greater efficiency all around. —ARTHUR SILVESTER.

IT IS all very well to have the foreman punch the clock, but it seems wrong not to have the men punch too. Punching the clock shows the men that there is a complete record of their time, it makes them toe the mark, and furthermore I don't see how costs can be arrived at if no clocks are punched. While the bonus to all will make each see to it that the other does his share, there will be a loss of time in doing so, unless there is a clock. The foreman would have to spend a good deal of his time getting after the tardy ones, and he in a sense would have to become a time clock. The foreman's dignity must be preserved, and it would suffer seriously if he were the only one to punch the clock.

As far as the bonus is concerned, there is nothing better, and it solves the problem of unreasonable demands. Everyone will admit the fairness of good pay when business is good, and the men who would object to a cut in wages when business is poor will see the wisdom of no bonus when the factory itself is not mak-

—J. C. P. BODE.

BONUSES for foremen give them something definite to strive for, and they lessen the monotony of routine life. There is only one better thing, and that is a bonus for all. One objection is that some may tend to lower the quality or accuracy of the work to increase the quantity. To counteract that, quality and accuracy should be made a factor in determining the bonus, and special attention given to the inspection department.

Another objection is that foremen may tend to drive the men too hard. The remedy for that is to give the bonus to all, and then the drive will be changed to a race, with all running in the certain knowledge of a prize for each one, an incentive for everybody, and an escape from the deadly monotony of getting the same old hand-out every pay day. —JOHN J. WOFFINGTON.

Will Standard T-Slots Help Production?

ODD-SIZE T-slots caused difficulty in my shop as they did in Al's, and to get over the trouble I machined the large tongues down to the smallest size slots. In putting the fixtures on the machines with the larger size slots, we clamped them down while the tongues were lined up from one side of the T-slots, and

found they did not move while under cutting tension. Therefore, it was not necessary to have tongues a snug fit in the T-slots, and by this procedure fixtures were interchangeable. It is now our standard practice to design all fixtures with the smallest size tongues.

The above statement is only a brief as to how we ended our difficulty, but my vote is solid for the standardization of the T-slots on machines, because it will help production, and save a lot of work in the tool designing office. The standard spindle end adopted for milling machines, together with the standardization of T-slots, will be a real boost in the rapid production of milled surfaces. Engineers of all nations will appreciate the great achievement of the American engineers.

—C. L. HENRY, *Foreman, England.*

Is the Company Picnic a Good Thing?

WHEN things are moving along at a rapid production pace every one is under a constant strain, and I believe the company picnic is one good way to relieve the tension. It gives a real opportunity for all concerned to get better acquainted. The general manager and the unloading gang find that they have some things in common, and so it goes on until the whole organization has a more friendly feeling, and much of the so-called "high-brow" idea is brushed away.

I think it is a good idea for the company officials and the works conference committee to work out the necessary plans for the picnic and then appoint the necessary committee to carry the idea through to completion. Games of all kinds should be provided. The basket lunch is a good idea, but let's have our eats on the old-fashioned long tables where all have a chance to get better acquainted, for that is the big idea of a company picnic. —FRANK A. HYDE, *Timekeeper.*

THE annual company picnic for the benefit of the relief fund was not a simple thing for us. We have a fair percentage of colored help, and there are many white people who want to keep separate, and the colored help also keep to themselves. We have been going to a noted summer resort by boat, and having races, etc., after landing. Two years ago, a separate program of sports was held for the colored help, giving them prizes of the same value as were on the other program. Last year, after engaging a park and making all arrangement, we found that only white people were admitted. So we gave some cash to a committee of the colored employees and they had their own picnic at a small park in the city, under their own management. —DAVID T. FLETCHER.

Hiring Back the Fired Workman

WHY did you fire him? Was it the result of a misunderstanding which has been straightened out? Then you should give him back his job. If you fired him for getting drunk, and you believe that he will now stay sober, then you will hire him back, that is, until you have tried it about a hundred times.

If you fired him because he was incompetent, or careless or impudent, it was your fault and you ought to take him back and make something of him. Incompetent workers can be made competent. Careless workers can be made careful. Impudent workers should be convinced of the futility of their ways at once. If you are a competent foreman you can do these things. If you fired him because he has not enough physical strength, or the mental ability to understand the job, you were wrong again. Take him back and put him on a job he can do.

—ENTROPY.

I DO not see any good reason why a man should not be re-engaged after having been discharged for a fault which is curable with time and experience. Once a man recognizes that he has made a mistake and admits it, there is some hope for him. Far from affecting the morale of a shop, an example of this sort tends to strengthen it.

The inveterate time-loser is a difficult man to give another chance, as his bad example is often imitated by others to the detriment of the shop. Another difficult type to deal with is the "politician," whose work and other people's suffers owing to his habit of indulging in "propaganda" at any favorable moment. I think the policy of giving a man another chance is sound, and generally justified by results. —T. GEE, *England.*

IF THE workman is fired for a serious offence, such as gross insolence, showing fight, or indifference to repeated pulling up, and becomes a bad example to the shop, it is fatal forever, and I let the workman know that. In reinstating a discharged workman, I always take into consideration the man's previous character, habits, efficiency and capabilities, and I have found that 9 out of 10 fit back into the shop reformed and better men. —H. MAPLETHORPE, *England.*

Getting New Blood in the Shop

THE choice of a new foreman depends on the efficiency of the man from outside and the possible foreman inside. If a man is selected from the inside, some of his fellow workmen may be "sore" because they may think they should have been promoted instead, and that opposition probably will balance the opposition to the man from outside. Changes generally incur antagonism from some one. Overestimation of his own ability, and detraction of the other fellow's, will usually make some one oppose the new foreman, no matter whether he comes from inside or outside. —J. J. WOFFINGTON.

Consulting the Foreman on Tool Design

THE primary object of a jig or fixture is to increase production by facilitating the handling of the work, and to reduce the cost. The designer should, therefore, not be satisfied in designing something that will do the work, but should also consider the method of handling in order to eliminate unnecessary movements.

To get the best results it is advisable to consult the shop foreman prior to beginning the work. In this way the designer will get first-hand information relative to the sequence of the job, the type of machine for which the tool is intended, and also practical advice relative to the type of tool best suited to the job. This method of procedure will also tend to create a feeling of co-operation between the engineering and production departments.

—CHARLES E. KIRKBRIDE, *Asst. Chief Draftsman.*

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Toolholder With Screw Adjustment

By Henry Simon
Jena, Germany

A toolholder for the screw machine that possesses the double advantage of being easily mountable in standard turret tools, and of having a fine and positive endwise adjustment, is shown in the illustrations. It is intended for light cuts only. Because of the accuracy of the longitudinal adjustment, it is particularly adapted to work where lengthwise dimensions have to be held to close limits, while its small size and long reach often render it of value on crowded set-ups that would otherwise be hard to handle.

In Fig. 1, the toolholder is shown applied in tandem to a regular Brown & Sharpe floating holder. It consists of two stems, as at *A*, threaded over the front portions and slotted so that the cutters will be a snug sliding fit. The cutters are clamped in place and are movable endwise of the stem by the two nuts *B* and *C*. The slightly reduced stem-ends pass through the bushing and are frictionally seated in reamed holes corresponding to the location of the regular clamp-screw hole in the floating-holder base, which in this case is special, since the regular base has threaded holes. The portions of the stems passing through the holes in the float have the threads turned off, in order to permit floating action without appreciably weakening the stems. Two nuts, as at *D* take the place of the regular float clamp screws, the stems being prevented from pulling out by the flat holding-nuts *E*.

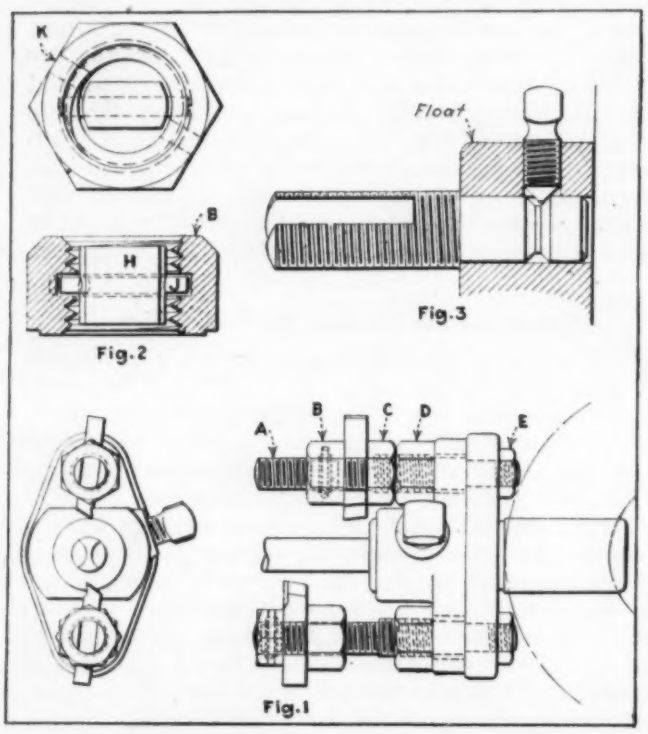


Fig. 1—Toolholder applied tandem. Fig. 2—Outer nut with follower. Fig. 3—A more rigid toolholder

In order to prevent the end pressure on the threads caused by clamping the tools with the nuts *B* from springing the slotted parts of the stems together, each of the nuts is provided with a follower, or center piece, *H*, as shown in Fig. 2. The follower, which is a flat piece, snugly fitting the slot in the stem, is free to rotate in the nut, and is kept in position by the pin *J* extending on both sides into an annular groove in the nut. A cross hole, as at *K*, permits the insertion or removal of the pin in the follower.

The use of toolholders of the type described, is not recommended where frequent adjustment of the float is necessary, especially when turning to close dimensions, since differences in tightening the float clamp-nuts may result in slight variations in the adjustments of the tools.

In Fig. 3 a somewhat stockier type of toolpost is illustrated. It it intended to be applied to a floating holder of heavy design. The float, being as thick all over as the bushing, more rigidly supports the stem. The stem is drawn up to the face of the float by means of a pointed setscrew, engaging a V groove in the stem. Heavy cuts on continuous work may be taken with this tool.

Making Special Micrometers

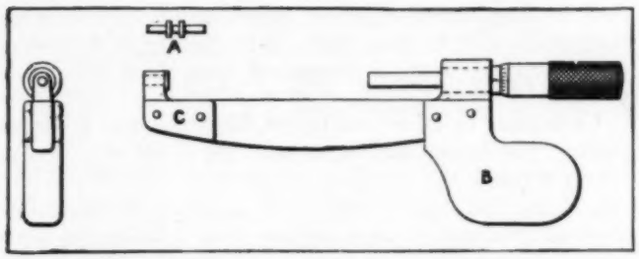
By Arthur Wormwood

A type of special micrometer, of which several have been made in our toolroom, is shown in the sketch.

In order that a solid anvil could be used, a micrometer head that is adjustable was selected. The thimble is made in two parts, the graduated part being threaded into the knurled part. Since the knurled part is rigidly attached to the spindle, adjustment can be made by screwing the graduated part in or out, by means of a special wrench.

The frame was milled to shape, after which the sides were ground and lapped straight and parallel, so as to prevent any springing when held for boring. Holding the frame in the milling-machine vise and lining it with the spindle, the hole for the spindle was bored. Then the vise was turned half-way around and the hole for the anvil was bored.

In the meantime, the anvil was turned, each piece making a pair, as shown at *A*, one for each of two micrometers. After being hardened, they were cut apart by a thin abrasive wheel, care being taken to avoid drawing the temper. Each anvil was then pressed into a hole in



One of the special micrometers

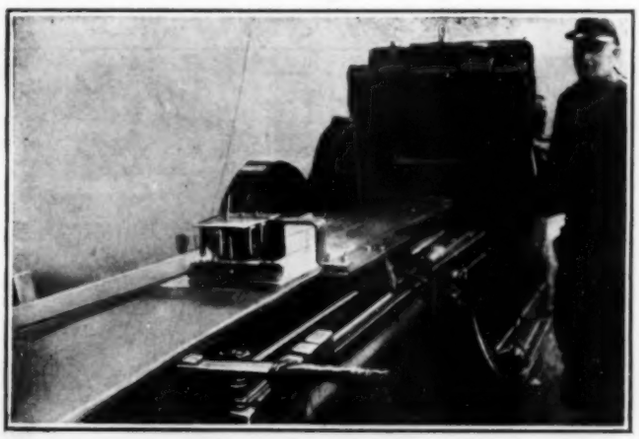
a block of steel, the base of which was accurately square with the hole. Held in this way on a surface grinder, the faces were ground, leaving the heads the proper thickness.

Each anvil was pressed into its frame and the micrometer head was wrung into place and doweled to prevent turning. To aid in handling and to prevent distortion from the heat of the hand, a Bakelite handle and an insulating pad of the same material were attached at *B* and *C*, respectively. The average error in parallelism of the heads and anvils did not exceed 0.0002 inch.

An Electrically-Operated Tripping Device

By Milton Wright

The illustration shows an electrically-operated stop applied to a machine for straightening and cutting off strips of sheet metal. One wire of an electric circuit is grounded on the machine, and the other is connected



Electric stop on cut-off shear

to an insulated bar of brass that is suspended from a bracket attached to and adjustable along the table upon which the strips of metal run out as they emerge from the rolls of the machine.

When the strips have reached the contact bar and raised it from the wooden surface of the table, the circuit is closed through the strips themselves to the machine, and thence through a solenoid that acts to declutch the rolls, apply a brake to stop the machine, and trip the shear to cut off the metal.

Because of the momentum of the heavy rolls, the action of the device cannot be expected to be instantaneous, but the length of the strips cut off may be controlled within ¼ inch.

Chuck for Compressing Piston Rings

By Howard Campbell

The device illustrated is for compressing piston rings so that when loaded on a mandrel, they can be ground to size while compressed. It consists of a chuck having eight special jaws, two upright studs, an end plate fitting over the studs, and two mandrels, all of which are shown in Fig. 1, with the exception of the extra mandrel.

The jaws slide in dovetailed slots, in which they are gibbed, and are connected by links to a wormwheel at the

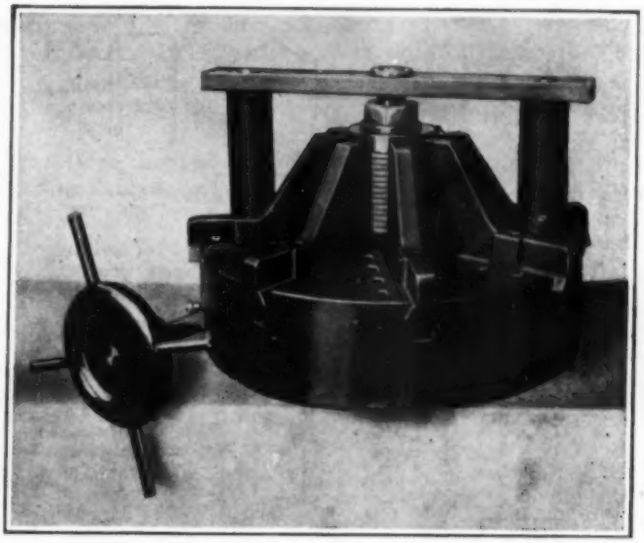


Fig. 1—Chuck for compressing piston rings

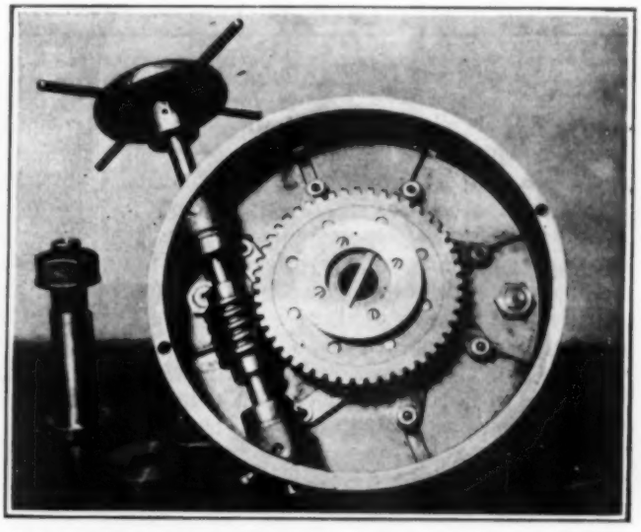


Fig. 2—Rear of chuck showing worm gearing and links

back as shown in Fig. 2. They are moved toward or away from the center by partially revolving the wormwheel by means of its mating worm.

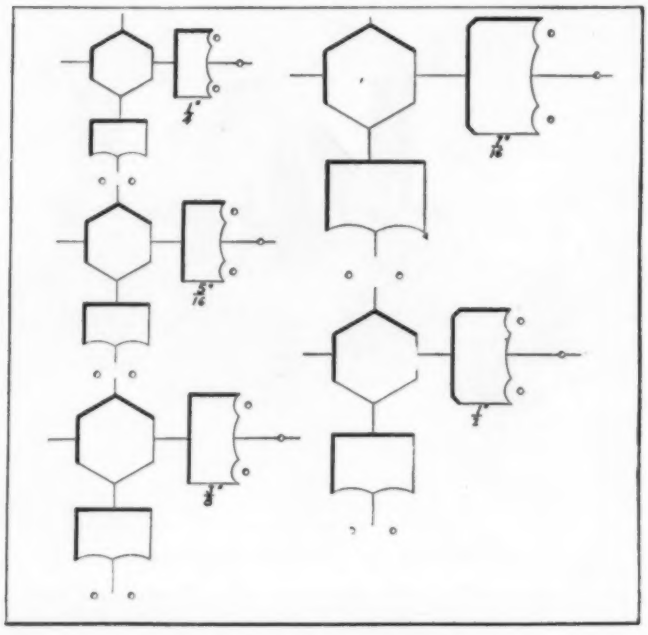
In operation, the end of a mandrel is placed in a bushing in the center of the chuck. The rings are placed on the mandrel and the collar and nut are put on. The end plate is then put on, its holes fitting over the studs and the outer end of the mandrel, holding it central. Then the rings are compressed the desired amount by moving the jaws toward the center, after which the nut is tightened, holding the rings in position. A pilot wheel on the worm shaft is provided for ease of operation.

A Draftsman's Time Saver—Discussion

By Henry Simon
Jena, Germany

In an article under the title given above, on page 29, Vol. 66, of the *American Machinist*, P. H. White described a very serviceable draftsman's capscrew-head templet. It is certain that almost any draftsman will save a great deal of time by the use of such a tool, especially in laying out the drawing in pencil.

A different and slightly more complicated type of templet for the same purpose, which I designed for my



Templet for drawing screw heads

own use, is shown in the illustration. It is more trouble to make, but it has the advantage of giving practically every element of the different screw heads, from both angles from which such screws are likely to be drawn, and the additional important point that it permits the arc-centers to be accurately prickmarked for use in inking-in later. As every draftsman knows, even slight shifts in the location of these centers have a tendency to cause unsightly appearances of the screw heads. Where the arcs only have previously been marked, the centers still have to be found, which is a tedious job where a dozen or more capscrews are to be shown.

As will be noted, the order of things is reversed in this templet, in that the arched upper edges appear at the bottoms of the openings, which are made to the correct height of the head. This is not without its advantages, for by having internal rather than external corners, the tendency of the pencil to run wild in passing the point where two arcs join is avoided, and a neater drawing is made possible. The opposite edges of the openings are utilized, for the larger sizes of screw heads at least, by showing the true bevel of the edge when viewed from the three-faced side, and this outline can therefore be added to the drawing without the use of T-square and triangle.

It is a good plan to make a templet of this kind square in form, in order to give it an equally good footing on the T-square, no matter which way it is used. Another point is that the center lines on the templet should be fine, but very black, something which is not usually the case in home-made celluloid instruments. By drawing such lines with a sharp point, very lightly, and rubbing lampblack into them, a permanent, fine, black line can be produced.

Care must be taken not to get the arc-center holes too large. The better way is to push the point of a divider barely through the material, and then to trim off the burr raised on the under side with a sharp knife. This method produces a tapered hole that will fit the point of the instrument to be used in making the prick marks, and therefore locates the center accurately.

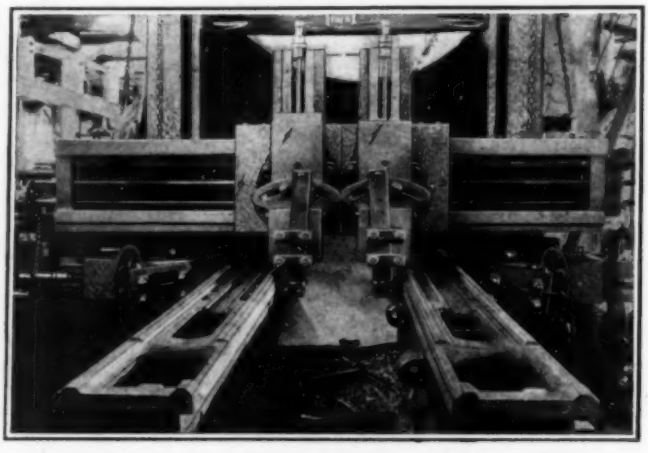
Power Cross-Feed on the Side-Heads

By Joseph Dashner

Though the side-heads of a planer are usually provided with means to feed them vertically on the faces of the housings, there is seldom any provision made to apply power to feed them either horizontally or at an angle, so that when using tools in these heads for undercutting or planing at an angle it is necessary to feed them by hand. The illustration shows the application of a power feed to the tool-slides of both side-heads.

Ordinary bicycle chain is the medium used to transmit the power. Special sprockets are secured to the screws of the side-heads and to the cross-feed screws of the heads on the cross-rail. The regular ratchets on the cross-feed screws govern the rate of feed, the relative diameters of the large and small sprockets being calculated to make the rate of feed uniform for each tool. As will be seen in the picture, one side-head is connected to the upper and the other to the lower screw in the cross-rail.

The tools in the side-heads are planing the overhanging portion of the shears of standard machine beds. The



All four tools are power fed

tools on opposite sides of each bed are feeding toward each other at the same rate of traverse. The tools in the main heads are special undercutting tools, each having a small horizontally-disposed clapper box at the lower end of the bar and a jackscrew in the upper end to prevent the main clapper box from lifting.

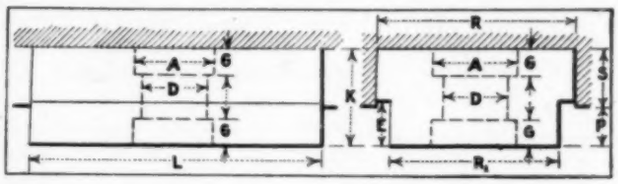
Which is better—group drive or individual motor drive? Probably another of the eternal questions. There are just enough variables to be considered to make it necessary for individual cases to be decided upon facts that can be determined.

Standard T-Slots for Machine Tools

(Continued from sheet 13a)

It is apparent that it will take a considerable length of time before all existing machine tools can be changed over, or new equipment installed, incorporating the new standards. To provide during this transition period for the interchange of attachments fitted to T-slots having a throat in some cases equal to and in other cases wider than the nominal sizes of the T-bolts, a special reversible tongue has been provided. The standard reversible tongue adopted for this purpose is shown in Fig. 6, and the standard dimensions for it are listed in Table VI. Dimensions have also been standardized for a series of tongues so that a pair of tongues will adapt fixtures to machines of different sizes and using different sizes of T-bolts. Tongues will also adapt the fixtures to be used on different machines having two widths of slots for the same size of T-bolt. In Figs. 7 and 8, and in Tables VII and VIII these standards are shown with their corresponding dimensions.

Fig. 7—Reversible tongue and seat



The adoption of these standard T-slots with their corresponding attachments will mark the beginning of complete interchangeability of tools and fixtures so that these tools can be transferred from machine to machine in the same shop or in different shops. The large stock of different sizes of T-bolts and nuts necessary to keep on hand in the shop will also be greatly reduced, and delays in set-up due to this factor will be eliminated.

The standards are also expected to procure a means of assuring better fitting of fixtures and bolts to the various machines. In adopting the standards the committee gave careful consideration to the important features of design, such as the strength of overhang of the slot, and the allowance for replaning of the machine table. Needless waste of time on the part of individual designers is thus avoided, as well as any individual errors arising from that source.

Table VII—Dimensions for Reversible Tongues and Seats for T-Slots of Two Widths with Same T-Bolt

Diameter of T-Bolt	Tongue Dimensions: Width R1	Width R	Length L	Projection P	Depth of Seat S	Total Thickness Including Tongue K	Height of Shoulder E	Screw Dimensions: Diameter of Screw D	Number of Screw	Threads per Inch	Diameter of Head A	Thickness of Head G
1/4	1/4	9/32	3/8	3/32	1/8	7/32	3/32	0.125	5	40	0.196	0.081
5/16	5/16	11/32	15/32	1/8	5/32	9/32	1/8	0.164	8	32	0.260	0.107
3/8	3/8	7/16	9/16	1/8	5/16	9/64	0.190	10	24	0.303	0.124	
1/2	1/2	9/16	3/4	3/16	7/32	11/32	3/32	1/4	..	20	0.375	0.130
5/8	5/8	11/16	15/16	1/8	1/4	3/8	3/32	1/4	..	20	0.375	0.130
3/4	3/4	13/16	1 1/16	1/4	9/32	7/16	5/16	5/16	..	18	0.438	0.150
1	1	1 1/16	1 1/2	7/32	11/32	9/16	1/4	3/8	..	16	0.500	0.170
1 1/4	1 1/4	1 5/16	1 7/8	1/4	3/8	5/8	9/32	3/8	..	16	0.500	0.170
1 1/2	1 1/2	1 9/16	2 1/4	5/16	3/16	3/4	11/32	1/2	..	13	0.625	0.210

Fig. 8—Reversible tongues for two widths of T-slots

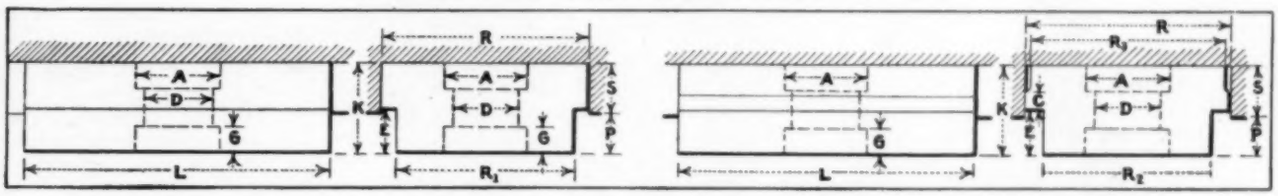


Table VIII—Dimensions for Reversible Tongues for Two Widths of T-Slots

Diameter of T-bolt Small	Diameter of T-bolt Large	Tongue Dimensions: Width R1	Width R	Width R3	Width R2	Length L	Projection P	Depth of Seat S	Total Thickness, including Tongue K	Height of Shoulder E	Thickness of Land G	Screw Dimensions: Diameter of Screw D	Number of Screw	Threads per Inch	Diameter of Head A	Thickness of Head G
1/4	5/16	9/32	11/32	5/16	3/8	15/32	1/8	5/16	5/16	1/8	5/16	0.164	8	32	0.260	0.107
5/16	3/8	11/32	7/16	3/8	5/16	9/16	1/8	7/32	11/32	9/64	5/16	0.190	10	24	0.303	0.124
3/8	1/2	7/16	9/16	1/2	3/8	3/4	1/8	1/4	3/8	5/32	5/16	0.250	..	20	0.375	0.130
1/2	5/8	9/16	13/16	5/8	1/2	15/16	1/8	5/16	9/32	13/64	5/32	1/4	..	20	0.375	0.130
5/8	3/4	11/16	15/16	3/4	5/8	1 1/8	5/32	3/16	11/32	3/16	5/32	5/16	..	18	0.438	0.150
3/4	1	13/16	1 1/16	1	3/4	1 1/2	7/32	3/8	13/32	1/4	5/32	3/8	..	16	0.500	0.170
1	1 1/4	1 1/16	1 5/16	1 1/4	1	1 7/8	1/4	7/16	11/16	9/32	1/8	3/8	..	16	0.500	0.170
1 1/4	1 1/2	1 5/16	1 9/16	1 1/2	1 1/4	2 1/4	5/16	1/2	13/16	11/32	3/16	1/2	..	13	0.625	0.210

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Technical Abstracts

Co-operation Between Hammer Builders and Users

In a paper delivered at the American Drop Forge Convention, May 18, Mac Donald S. Reed, sales engineer of the Erie Foundry Co., made a plea for co-operation between hammer manufacturers and drop forgers with the idea of standardization of sizes, parts, and practices.

It was suggested that the number of sizes in which both steam and board drop hammers are at present manufactured might be reduced to about half and still cover the field adequately. This would eventually result in economy to the manufacturer and user, although for some years to come it will be necessary to continue the manufacture of all sizes in order to supply parts to customers.

Standardization of die notches in rams, sow blocks, and trimming press rams was considered of great importance. Standard notches have already been adopted by foreign customers and, when orders for new hammers are received by cable, it is not necessary to wait for detail drawings before work can be started. In this respect certain foreign countries are ahead of us.

There are a lot of considerations that the manufacturers would like to have data on from the drop forgers. For instance, is the maintenance less on a hammer that is larger than the required size for a certain operation, are there metallurgical reasons why a heavy hammer is better for a particular piece than a light one, could higher speeds than those at present available be used? The answers to these and similar questions can best be supplied by the drop forgers since actual conditions cannot be duplicated on the manufacturer's test floor.

Anvil size is an important question. Present practice is to arbitrarily make the anvil 20 times the weight of the falling parts; but one customer has been insisting on a 30 to 1 ratio and this, or some other ratio, may be better than the arbitrary 20 to 1. It is alleged that with the heavier anvil maintenance cost has been materially reduced.

The question of anvils brings up the question of foundations. It has been customary to carry a concrete foundation down to a solid footing. Above the concrete a horizontal course of timbers, bolted together, has been laid and on top of this a layer of vertical timbers has been used to support the anvil casting. Lately the opinion is expressed that equally good results can be obtained, at a lower cost, if the vertical course of timbers is omitted and only 2 or 3 layers of horizontal timbers used, alternate layers running in opposite directions. Maintenance has been reduced in some instances by means of the latter arrangement. Other substances than wood have been used for cushioning, but not much data are available as to results.

It should be possible to establish certain standards of performance for various types and sizes of hammers. There is a great difference between the steam consumption of a new hammer and that of a worn one. This brings up the question of how often to overhaul. Tests have been made, by means of steam indicators and the deformation of copper pieces of uniform size, by the manufacturers; but when it comes to the actual costs of operation and maintenance, the drop forgers are in possession of the only reliable data available.

Many drop forgers are ready to set a definite size limit below which they believe that the steam drop hammer cannot compare with the board drop. Lately the tendency has been growing to use board hammers for the smaller sizes. In connection with board drops there are also many subjects for investigation in order to simplify design and effect economies in manufacture and use. — *Forging - Stamping - Heat Treating*, June.

Answering Help Wanted Advertisements

There are three types of men who answer blind advertisements: The rover who only lingers on a job for a few months, and then moves on because the salary doesn't come in fast enough; the man who seeks to improve himself; and the man who is forced through some change in management to seek a job elsewhere.

The second type of man is usually young, probably between 23 and 28. He is industrious and ambitious to succeed. He plugs along in his job, and may even do some unusual piece of work, getting a raise or two. Two years or more go by, and after studying carefully the makeup of the company with which he is associated, he finds that a real opportunity does not exist, in spite of what the boss may say. Fearing a rut, he starts to look around, and answers advertisements.

From time to time over a period of about fifteen months the writer of the article answered advertisements in various papers, and only received three replies. While this low percentage of replies may be considered good, the better type of man must become discouraged in answering blind advertisements. Bitter experience teaches him that the results are hardly worth the effort. The young man of today wants to write to something that is alive, not a mysterious, dead number.

Here are some of the questions that arise regarding blind advertisements: Why are the concerns seeking men so vague in stating what they desire? Are they trying to get a bargain when they say "state salary"? Was the man who got the job engaged on his reply, or by some other method? How long did the man hold the job? Some employer who reads the replies he receives from a "man wanted" advertisement should tell frankly what determined him in the letter to interview the writer. And some man who actually landed a job by answering a blind advertisement should tell how he did it, and if it were profitable.—*Printer's Ink*, June 9.

Arc-Welded Spark Plugs

In the past it has been the common practice to make spark plugs by assembling the outer steel shell around the porcelain core in two halves and threading these two halves together. By this method, the lower end of the upper half is threaded into the upper end of the lower part and the two halves are screwed together, tightening two copper gaskets onto the porcelain core. Very often this tightening process injures the gaskets, thus making it necessary to take thos plugs apart, put in new gaskets, and repeat the assembly.

By using a welded construction, no mechanical changes have been required and rejections due to leakage have been eliminated. The two halves of the steel shell and two copper gaskets are assembled on the porcelain core in a chuck or arbor which exerts a pressure of 60 lb. or more depending on the size and type of plug. After assembly, the plug is revolved in the special arbor for the welding operation.

For making these welds a welding current of 150 to 175 amp. is used, furnished by a single-operator welding machine of the brush-shifting type.—C. E. Baker, *General Electric Review*, July.

Low-Temperature Electric Oven for Industrial Application

In the average electric oven, the simplicity of construction is a point to be borne in mind constantly. The temperatures are so low, usually below 700 deg. F., that with the exception of the heating element, steel may be used for all parts of the oven. In choosing an electric oven, the floor space available will determine whether a box type or conveyor unit can be used, while the amount of production will indicate whether a conveyor oven would be justified. When small box-type ovens are employed it is always advisable to make use of standard sizes of which there are a number available, and it is not serious nor disadvantageous to have an oven slightly too large for the work being done unless the installation cost is entirely out of proportion.

One of the most important features of electric oven design is a method used

for circulating air through the chamber, which includes the quantity of air exhausted as well. For work such as drying or armature baking, natural ventilation is often sufficient. In any case, some ventilation if properly directed will improve the temperature distribution in the oven. Without ventilation the heated air will naturally rise to the top of the oven and be pocketed there, while the bottom will be cooler by 100 deg. F. or more. In small box-type ovens for armature baking or light drying jobs, natural ventilation is ordinarily provided by means of vents along the walls under or behind the heaters, which serve as intakes, and a larger vent in the roof with a damper so that the overflow may be controlled. In order to increase the flow, the exhaust is often connected to a stack, so that a slight draft may be obtained. Mechanical ventilation is almost always used in larger ovens and invariably so in conveyor ovens because the motion of the work makes positive control imperative.

Whenever forced ventilation is employed, the blower should be so mounted that the motor and fan bearings will not be overheated by combustion. The fan itself, particularly when it is used to exhaust the japanning vapors, should be of the straight paddle-wheel variety for it has been found dangerous to use fans with curved, or Venturi blades because the heavy vapors condense on them and fill up the curves, gradually reducing the effective discharge area, so that the correct volume of air is no longer handled. Oven explosions have been traced to this cause.—Edwin Sleischmann, *Industrial Engineer*, June.

Paper Tests for Blanking Dies

The test consisted in placing a sheet of tough paper on the die and allowing the punch to enter to a depth of about 0.0015 in. The clearance was supposed to be about 0.0025 in. on all sides of the punch and a bond paper of 0.003-in. thickness was used for the impression. If the clearance is exactly right it will be indicated by the clean folding of the paper all around without any breaks except, possibly, at very sharp angular corners. In other words the paper is compressed about 0.0005-in., whether the edges are sharp or dull.

If the clearance is decreased beyond this point, however, the paper will be broken; a very clean cut showing the existence of sharp edges on both punch and die while a ragged cut would indicate either a dull punch or a dull die in addition to insufficient clearance, or else it would show a condition where, although the tools were sharp, there is still enough clearance to prevent the paper from being clearly severed yet not enough to keep it from being broken.

Examination with a high-powered glass will show which condition exists, as the dullness or sharpness of any portion of either punch or die will be reflected in the appearance of the impression of the cutting edge in the paper.—Henry Simon, *Machinery*, May.

Lubricating Oils

The results obtained by A. G. Marshall and C. H. Barton after investigations covering a period of years, outlined in a paper presented to the Chemical Engineering Group of the Society of Chemical Industry, are particularly interesting to automobile engineers, since the properties indicated by laboratory tests were checked under operating conditions.

The first factor tested was "oiliness," this being the name given to the lowering of the coefficient of friction, in a Deeley machine, on adding a small proportion of a fatty oil to a mineral oil.

As regards piston lubrication, no difference was found between a straight mineral oil and the same oil compounded with 10 or 20 per cent of a fatty oil, both torque and temperature rise being determined. A mineral oil and a compounded oil of equal viscosity gave similar results in a small sleeve-valve single-cylinder engine.

A deceleration test, under actual running conditions, was devised to determine piston friction. There is practically no difference between the friction resulting from flooded and moderate conditions of lubrication. The effect of oiliness does not enter into lubrication under any conditions such as practical engineers would care to use, although in starved lubrication, good fatty-oil blends show a difference of as many as six revolutions compared with an average of twenty with mineral oils. Some fatty oils show a greater increase of friction, evidently due to gummy matter forming quicker than the fresh lubricant can remove such decomposed material.

Tests of fifty hours' duration were run under economical lubrication conditions in an engine having a specially designed high-temperation cylinder. Friction was measured by periodical deceleration tests. A straight mineral oil gave the best performance. Certain popular lubricants containing fatty oils failed to complete the test, owing to carbon deposits leading to seizure.

It is concluded that a measurement of oiliness is no indication of the practical value of a lubricating oil, since this property has no influence on either friction or wear. Substances are frequently added to mineral oils that do more harm than good as they cause harmful deposits.

It was found that laboratory tests for carbonisation did not correspond to engine results. The fact was pointed out that oxidation tests invite danger, and in particular, that the use of residual filtered cylinder stock flattens the viscosity curve, reduces the oxidation figure, and generally improves the oil from a popular specification point of view, but in service it produces carbon and may lead to lubrication failure.

Sludge determinations also indicated that present-day laboratory tests not only exaggerate the differences between oils, but cannot be relied upon to indicate the correct order of merit.

Conventional viscosity analyses are misleading. For starting in cold weather the viscosity at low temperature is of great importance, and the viscosity curve should always be considered in relation to the pour test.—*The Automobile Engineer*, England, June.

The Frisco's Experience with Lacquer

Since November, 1924, the St. Louis-San Francisco has applied Duco finish to 270 passenger cars of both wood and steel construction, to 626 locomotives, and lately to the interiors of 30 passenger cars.

The results on steel equipment have shown marked advantages over former finishes of application, durability under adverse climatic conditions, and attractive appearance which improves after repeated cleaning. From the standpoint of durability, lacquer finish on wooden cars has not always been satisfactory, but a flexible lacquer, designed especially for wooden exteriors and interiors has been in service for about a year, with good results.

Experience on the Frisco has been that equipment can be finished with lacquer, using a spray gun, in one-half the time as compared with varnish. While varnished cars had to be refinished every 18 months on an average, the cars sprayed with Duco, in most cases over the old undercoats, have been in service as long as 30 months with no attention except cleaning.

The life of varnish on locomotives is from 12 to 18 months, while that of Duco is from 18 to 24 months.—H. L. Worman, *Railway Age*, June 25.

Trend of Fusion Welding Research

Although the welding of non-ferrous metals is important, from the research angle the greatest interest is involved in the welding of steel because of the weld strength that must be developed. Steel welds made with Norway iron develop a tensile strength of about 47,000 lb. per sq.in. for single V welds and 52,000 lb. per sq.in. for double V welds. Welding rods recently developed make it possible to depend on values of 58,000 and 63,000 respectively, for the two types of welds. Heat treated welds good for better than 100,000 lb. per sq.in. have been made in airplane construction.

Field research is as important as laboratory research because the human element must be considered. An example is the work done by the welding supervisor on a pipeline job where poor results were obtained with high strength rods by welders experienced in the use of low carbon rods. The supervisor was not satisfied and spent several days experimenting with the high strength rods until he was able to produce consistently welds that could be bent 180 deg. Then he taught his most progressive welder what he had learned. This man's welds were so much better than those of the other welders in the regular tests that they became anxious to learn how it was done. The resulting competitive spirit solved the problem of getting satisfactory welds from the high strength rods.—I. R. Dawson, *Journal of the American Welding Society*, June.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Commencing Volume 67

WITH half a century of effective service behind it the *American Machinist* begins with this issue its 67th volume. Many marvelous mechanical developments have been witnessed in that period but they will doubtless be relegated to the commonplace by the developments yet to come. At the expositions to be held in Cleveland and Detroit in September the new machine tools and other types of production equipment that will be introduced will certainly render much existing equipment obsolete. Progress in the mechanic arts is at a constantly accelerating pace and the *American Machinist* is proud to chronicle it and occasionally to predict it.

The editorial staff that will produce Volume 67 is composed of Kenneth H. Condit and Fred H. Colvin, editors; L. C. Morrow, managing editor; A. L. DeLeeuw, consulting editor; and S. Ashton Hand, Ellsworth Sheldon, H. V. Doyle, Jr., W. E. Irish, Frank W. Curtis, F. J. Oliver, Jr., and G. S. Brady.

Wages and Purchasing Power in Europe

LAST year a British commission visited American manufacturing centers and reported on what appeared to it to be the secrets of American industrial prosperity. This year the International Economic Congress at Geneva pondered the same questions at length. "But we do not have your great purchasing population. Our people do not furnish a large home market," seems to be the European answer when American prosperity is compared with the painful slowness of recovery in most of the European countries.

Buying populations depend for their purchasing powers on only one thing, income, and the great mass of population obtains that income from wages paid by industry. When one ponders on the wide divergence between wages paid in Europe and those paid in the United States there seems to be apparent one of the fundamental causes for the lack of home market. Certainly it is not population alone, since the combined populations of Great Britain, France, and Germany far exceed that of the United States.

Figures published by the Bureau of Labor Statistics show that skilled mechanics in Germany and France frequently receive only one-fifth the wages paid in the United States, and those in England only about one-third. In Spain and Italy the wage scale is even lower, while in particular industries the wages paid are as low as one-eighth those paid in America.

It is no easy task to recommend measures that will bring about the economic adjustment of industry in a whole continent, but it can be readily seen that there cannot be world stability until there is greater equilibrium in economic fundamentals between the two continents. Europe pays approximately the same prices as America for foodstuffs and materials bought in foreign markets, with the result that the European worker has to accommodate himself to a low scale of living, and has no reserve to make a "home purchasing market." Low scales of living also make for decreased efficiency, and the vicious cycle thus set up may be the reason why European production per worker is sometimes only 15 per cent of that of American workers. The European economic problem is too large to expect its solution in a short space of time, but once European industrialists have recognized the shortcomings of their industrial system it is to be hoped that effective measures for betterment will be taken.

Hand Tools Wanted

THIS is an appeal to readers of the *American Machinist* in behalf of the Museum of the Peaceful Arts in New York City. The need at present is for ancient hand tools for working wood or metal for use in a temporary exhibit that is now on view at 24 West 40th St., New York.

Some months ago the plan for the arrangement of the industrial equipment in the museum was published in the *American Machinist*. Since then a site has been secured and plans for the structure to house the exhibits are in process.

To stimulate interest in the project the temporary exhibit of samples of the different types of tools and machines that will make up the permanent exhibit is being collected. A few interesting old tools are on view but there is room for many more. The directors of the museum are seeking old tools that have historic value, which means that they must be both significant and authentic. Readers who have tools of this sort in their possession that they are willing to donate or consign, or who know where they can be secured, are urged to send them or write concerning them to the museum of the Peaceful Arts at the address given.

Shop Equipment News

Barrett Adjustable Horizontal Boring Machine

THE Barrett Machine Tool Co., Meadville, Pa., has designed the adjustable horizontal boring machine shown in the accompanying illustration along the same lines as the standard fixed-bar type with the added advantage of a vertically adjustable spindle. The machine is manufactured in 3-, 3¼-, 5- and 6-in. bar sizes.

The bed is of box type construction, deep and well ribbed. The top surface is provided with longitudinal and cross T-slots. The column is mounted on the left hand end of the bed and is also of box construction, heavily ribbed and well braced. The front face is provided with two T-slots and a groove for clamping and guiding the saddle.

The saddle is also of box type construction and is cast in one piece with the extension. It is provided with vertical adjustment on the face of the column by means of an elevating motor or handwheel. Rigidity and alignment are provided through a tongue and groove and a T-slot clamping arrangement. Safety screws prevent the saddle from being loosened beyond the sliding point when the clamping nuts are freed.

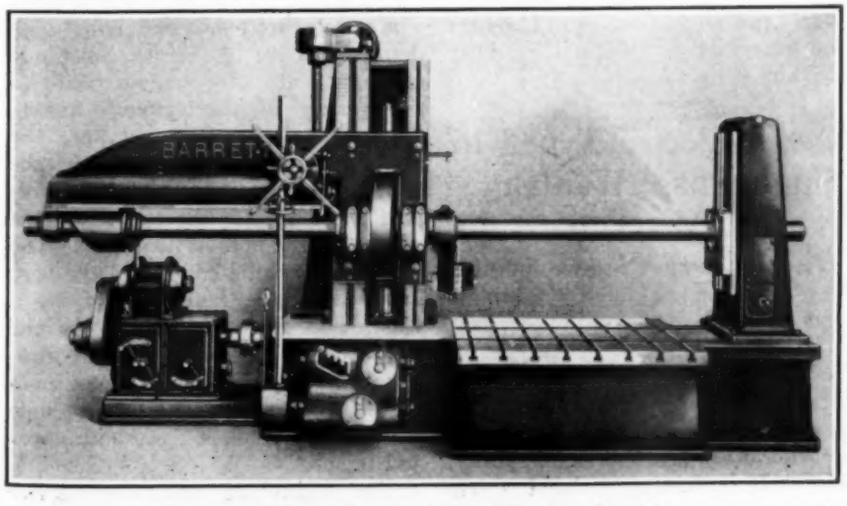
The boring bar is made of high-grade hammered steel, accurately machined and finished. It slides in cast-iron sleeves and is driven from the sleeves by a long key. The end of the bar is fitted with a Morse taper socket to accommodate auxiliary bars when desired. The feed carriage is arranged with a quick acting lock for use when changing position long the bar. The regular quick-change feed mechanism provides a range of feeds necessary to cover the requirements for the boring and facing capacities of the machine. A reversing mechanism is also included so that the feed may be reversed without disturbing the setting. The outer support of the bar is of the housed type and is provided with T-slots for clamping to the slide. Vertical hand adjustment is accomplished with a crank through miter gears and a screw.

Drive for the bar includes a speed box mounted on the bed proper and connected to the drive shaft with a coupling. A constant-speed motor, either a.c. or d.c., is connected to the friction clutch of the speed box with silent chain. All gears are made of steel and run in oil and the selective driving gears are operated by levers conveniently located. A clutch lever controls the starting and stopping of the machine. Power from the speed box is transmitted through a pair of steel bevel gears to a vertical shaft carrying a Hindley worm, which in turn drives the wormwheel on the bar sleeve. This worm and wormwheel run in oil. Belt drive can also be furnished when desired.

The facing arm is mounted on the end of the bar sleeve. It is driven by friction and may be started or stopped at will by simply tightening or releasing the collar bolts. When not in use, it hangs on the end of the sleeve and does not interfere with the rotation of the bar.

The cross table is not furnished as regular equipment but can be supplied if desired.

Ball thrust bearings are provided on the elevating screw, feed screw, boring bar, spiral feed gears, worm gears and all other positions where a thrust load is imposed.



Barrett Adjustable, Horizontal Boring Machine

Black & Decker Electric Hammer

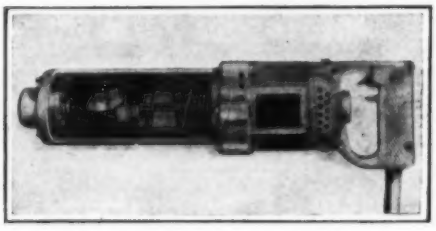
The electric hammer shown in the illustration has been built by the Black & Decker Manufacturing Co., Towson, Md. The motor in this hammer is the same type as used in the portable electric drills made by this company with the exception of a few minor refinements, which makes it more applicable for this particular type of work. It is a universal motor operating on direct or alternating current from 25 to 60 cycles and on voltages 10 per cent above or below the rating shown on the name plate.

The armature of this motor rotates at approximately 10,500 r.p.m. and is equipped with an aluminum centrifugal fan which draws air in at the commutator end of the motor, passes it around the windings, and expels it through several ventilating holes in the field case opposite the fan. Automatically-adjustable ball bearings are used on the armature shaft, which is hollow to accommodate the spline shaft upon which the reciprocating hammer mechanism is mounted. This reciprocating mechanism, which actually strikes the blow, is made of a special drop forging upon which are mounted two beveled gears heavily weighted on one-half of their area. These weighted gears are driven by a beveled pinion on the spline shaft and, consequently, rotate in opposite directions. When the two weights

Shop Equipment News

are together at the bottom, the whole reciprocating mechanism mounted on the spline shaft moves downward, thus striking a heavy blow on the oil-tight piston which in turn transmits the blow to the drill or cutting tool. When the two weights are together at the top, the reciprocating mechanism travels up with equal force but the blow is absorbed by the coil spring, which is clearly shown in the illustration.

The motor does not take any of the shock of the blow due to the centrifugal coupling mounted on the end of the armature shaft which acts as a shock absorber. The spline



Black & Decker Electric Hammer

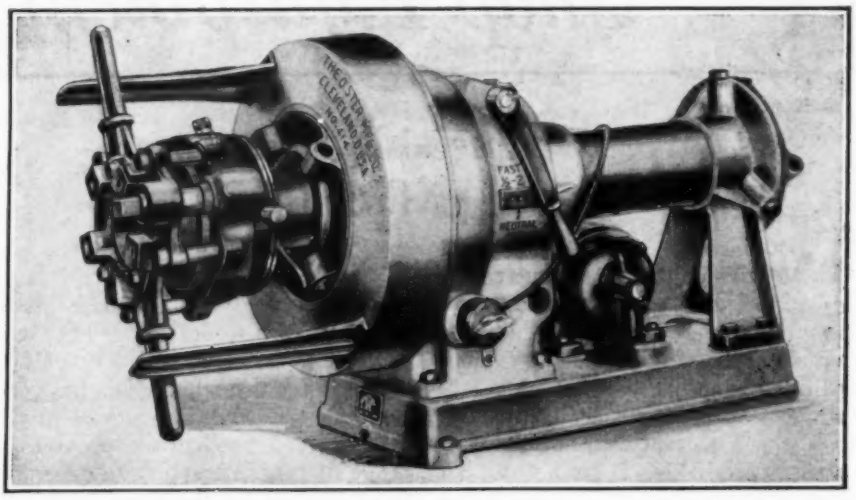
shaft carrying the reciprocating weights is driven by the motor through the coupling instead of direct and all shocks are absorbed through a flexing of this coupling.

The piston in the nose of the hammer has a suckfit, thus preventing any oil from passing. This piston is also supported by a heavy coil spring which absorbs the hammer blow when it is running idle. When the hammer is working, however, the spring is rendered ineffective and does not absorb any of the blow. The hammer strikes 2,300 blows per min. The entire working mechanism operates in a bath of oil and is sealed against dust and grit.

Oster No. 414 "Power Boy"

The 4-in. portable pipe threader shown is made by the Oster Manufacturing Co., Cleveland, Ohio. It is designated as No. 414 "Power Boy." It was brought out to meet the demand for a larger machine of the same type as the No. 412 2-in. Power Boy which has been on the market for a little over a year. The No. 414 is built of the same aluminum alloy as used in the No. 412 machine. It weighs 380 pounds.

The driving power is furnished by a ½-hp. universal motor, which will



Oster No. 414 "Power Boy"

operate on any 110- to 115-volt lighting circuit, either direct or alternating current, single-phase and of any cycle from 25 to 60. The motor is of the variable speed type to the extent that it speeds up on smaller sizes of pipe but holds the required speed on the larger sizes. In addition, a two-speed transmission is furnished to further increase production and power. A handy gear shift lever on the side of the machine enables the operator to change speeds quickly.

The pipe is held stationary in a 3-jaw self-centering chuck, and the pipe tools are turned by the driving arm. Self-centering universal guides in the rear of the machine assist the front chuck in centering long lengths of pipe. The machine will handle all sizes of pipe from ½ to 4 in., nominal size, and will drive geared die stocks from 4½ to 12 in. by means of an auxiliary drive shaft. Any square-end or roller type pipe cutter of 2-in. capacity can also be driven. The machine stands 24¾ in. high, 47 in. long and 20 in. wide.

General Electric Type I-16 Single-Phase Watthour Meter

The outstanding feature of this type I-16 single-phase watthour meter is its long-range accuracy, said to be attained without sacrificing other essentials that constitute a satisfactory measuring device for electric energy. The instrument is made by the General Electric Co., Schenectady, N. Y. It is further claimed it has high accuracy on overloads without

General Electric Type I-16 Single-Phase Watthour Meter

its light-load performance being impaired in any way. In the same way the meter's accuracy is maintained under varying conditions of temperature, voltage, power factor or frequency.

An improved magnet with high damping effect is said to contribute more than any other single factor to the quality of the meter. Among the mechanical refinements are the method of attaching the cover, the sealing arrangements and the light-load adjustment. A clockwise turn of the cover puts it in place. The joint between the cover and the base has been made tamper-proof by a wide, close-fitting steel rim on the edge of the cover. Means are provided for sealing the meter and terminal covers separately or a single seal may be employed for both cover and meter.

The light-load adjusting device permits adjustment from the front of

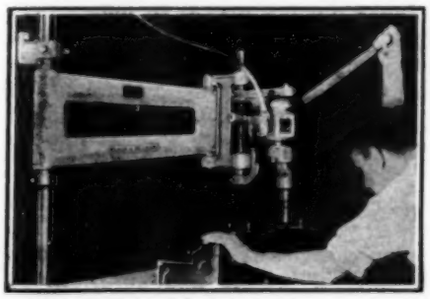
Shop Equipment News

the meter. It is claimed that greater precision of adjustment is possible with a saving of time as there are no clamping screws. The adjustment is positive.

Black & Decker Radial Arm for Portable Electric Tools

To facilitate the use of portable electric tools and, particularly, large size stud setters and nut drivers, the Black & Decker Manufacturing Co., Towson, Md., is offering the radial arm shown in the accompanying illustration.

The radial arm is furnished with heavy brackets that bolt or clamp to



Black & Decker Radial Arm for Portable Electric Tools

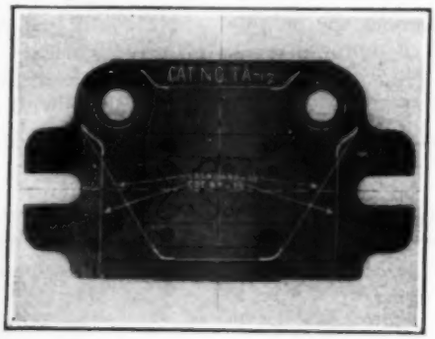
a wall or post, and these brackets support a large steel column which carries the arm. The arm has a vertical adjustment on the column of 24 in. and can swing through an arc of 180 deg. The distance from the center of the column to the center of the bearing carrying the bracket is 22 inches.

The bracket is designed to take adapter blocks for any Black & Decker electric drill ranging in size from ⅜ to ⅞ in., inclusive, and Nos. 3, 4 and 41 electric screwdrivers or socket wrenches. The bracket has a vertical travel of 3¾ in. and is operated by a hand lever with a 5-to-1 ratio. The distance from the center of the bracket bearings to the center of the spindle of the tool is 14 in., and this bracket has an angular adjustment of 245 deg. As a result, any area within radii from 19 to 36 in., measured from the point where the radial arm is attached to the wall, can be quickly and conveniently reached.

The weight of the radial arm is carried by a ball thrust bearing on the column, so that the unit swings easily.

Danly Transparent Die-Set Templets

The Danly Machine Specialties, Inc., 2104 South 52d Ave., Chicago, Ill., has added to its line of die-makers' and punch press accessories a series of transparent die-set templets, one of which is shown in the illustration. The templets are for use in determining the size and type of



Danly Transparent Die-Set Templets

die-set required for the particular die laid out on the drawing board.

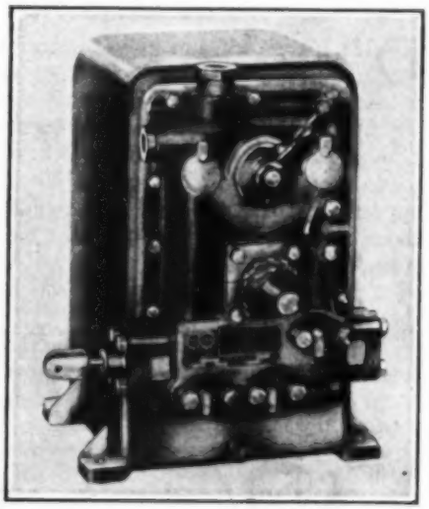
The templet consists of a tough, transparent material through which the details of the die drawing can be seen. There are thirty different templets in the complete outfit, covering 14 types and 113 sizes of Danly die-sets. In this way, the templets corresponding to the direct size of die set can be selected by trial.

A rubber stamp is furnished by which a tracing or blueprint can be stamped to indicate the set required. Ordinarily, two to four templets will suffice.

Oilgear Type "QS" Hydraulic Pump

An improved type of pump, designed especially for hydraulic feeds on milling, boring, drilling and similar machines, has been announced by the Oilgear Company of Milwaukee, Wis. It is known as type "QS". The pump provides forward and reverse feeds and forward and reverse rapid traverse.

The feeding delivery is adjustable, and the forward and reverse feeds are always equal. Control is by hand or automatic by a cam. The control valve has positions corresponding to the following functions: Full speed forward (rapid approach), feed



Oilgear Type "QS" Hydraulic Pump

forward, neutral, feed reverse and full speed reverse (rapid return).

When used with a two-to-one differential cylinder, 3⅞ in. in diam., this pump will give a feeding range from 1.66 to 23 in. per min. forward, and from 3.32 to 46 in. per min. reverse, with a corresponding rapid traverse speed of 93 in. per min. in either direction. These operating speeds can be varied through the use of different size cylinders. The maximum working pressure is 1,000 lb. per sq.in. The power consumption at maximum capacity is 2 hp., while the operating speed is 860 r.p.m. or lower.

Trade Catalogs

CHROMIUM PLATING. The Bureau of Standards, Department of Commerce, Washington, D. C., has published technologic paper No. 346 (Part of Vol 21) entitled "Electrodeposition of Chromium From Chromic Acid Baths," by H. E. Haring and W. P. Barrows. It may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents. The publication contains forty 7x10-in. pages and is illustrated with charts. A comparison of acid, neutral and basic baths is made, as well as baths containing compounds other than sulphates. Bath maintenance and analytical methods are also discussed and the anode and cathode are treated in turn. Equipment, power and costs are also included.

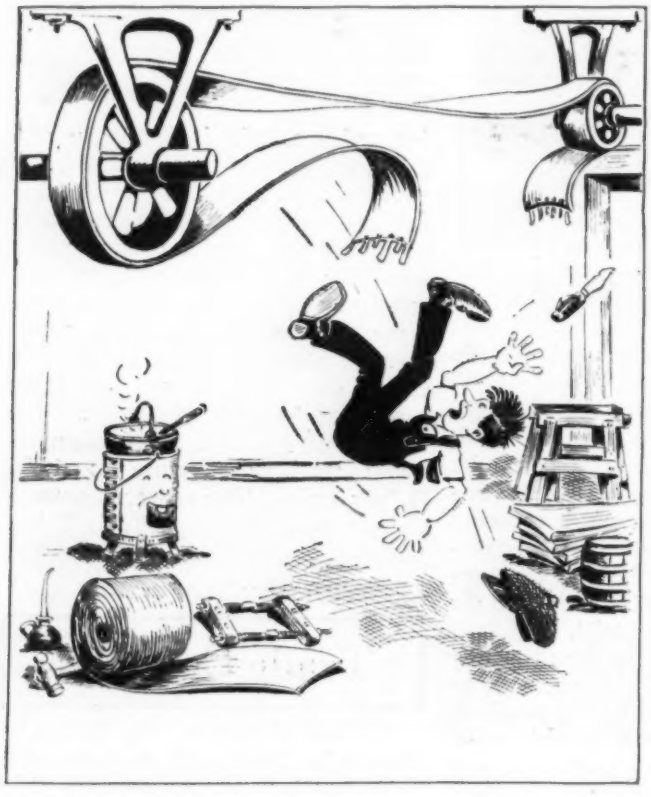
DRAFTING ROOM EQUIPMENT. The New York Blue Print Co., 102 Reade St., New York, N. Y., has issued an illustrated circular describing its line of drawing tables, filing drawers, scales, T-squares and other equipment.

How Fred Took Off the Belt

By Glenn Quharity

DID I ever tell you how Fred took off the 18-in. belt that transmitted power from the jackshaft to one of the main lines of shafting that drove the machines in an important manufacturing department of the old Brookdell shop? Fred ought to have known better than to do what he did, for he was serving his third year of apprenticeship in the "machine room" under the effective, though benevolent, tutelage of Charlie Pratt, and, besides, he knew all about the man who sat on the limb of a tree and sawed off said limb between himself and the trunk.

The two shafts between which the belt in question was stretched were on the same level and at the height usual in old-time shops before the days of motor drives,



which means that the belt itself was horizontal and the lower side just far enough from the floor, so that a well developed boy could jump up and grab it—if he wanted to.

The belt was an old one and had been put on many years before, but for some reason or other the ends had never been cemented to make it endless; the old-fashioned laced joint still remaining. It was to be replaced by a new belt, and Fred had been detailed to take it off of the pulleys after Bill Shailer "stopped the power" at six o'clock.

The new belt, a pair of horses, some planks, a belt-clamp and the "glue-pot" with its charcoal brazier, had already been brought from the belt man's domain in readiness for the job, but the staging had not been set up and the floor below the belt was clear—fortunately for Fred. Fred stood under the belt at six o'clock and by shouting directions—relayed to Bill, the engineer, by the junior cub from his station outside the shop door—had him "set" it so that the laced joint stopped in an easily accessible place, which happened to be on the lower side of the belt about midway between the shafts.

Though all night was before him in which to get the old belt off and the new one in place, and the belt man, who with Fred's assistance was to do the job, had gone home to supper, Fred determined to get *one* job off his mind before he ate. Whipping out his jack-knife and testing the keenness of its edge with his thumb, he stood on tiptoe and stabbed at the lacing with the tip of the longest blade.

He could just reach the lace but could not get in any effective work, so he sprang up and grasped the edge of the belt with one hand, hanging in mid-air while he sawed at the lacing with his knife in his free hand. It was not a comfortable position, nor could he make much progress with the cutting. More inventive genius was obviously required.

The horses and planks did not appeal to him. Very likely he never thought of them. He would cut that belt without outside aid or bust in the attempt. With a grin of satisfaction as the idea dawned upon him, he pocketed the knife, leaped for the belt and, grasping it by both edges, swung himself up and over it until he sat astride with the joint before him.

It was all so simple—and successful. Hardly had the severed the last few strands of lacing when the belt came right down. Conscious of a good job well done, and also of sundry bumps, bruises and abrasions on various parts of his anatomy, Freddy picked himself up and followed the belt man home to supper.

A Serial Number with a Meaning —Discussion

By F. P. Terry
Belfast, Ireland

THE suggestion of A. A. Merry on page 563, Vol. 66, of the *American Machinist* is so simple that one wonders why something of the sort was not in vogue years ago for thus identifying machine tools. It would be a perpetual reminder to the user of old plant of how many years he is behind the times.

In case Mr. Merry, or some other, should claim originality for this idea, and commit, unknowingly of course, "another injustice to Ireland," it may be mentioned that a certain world-renowned Irish brewery adopted this idea away back in the long-forgotten ages, and, to this day the label upon its barrels and bottles bears a number, which records the particulars about the products, as suggested by Mr. Merry for machine tools.

Drilling Chrysler Cylinder Blocks Erratum

Apologies are due Greenlee Bros. & Co., Rockford, Ill., for the errors on pages 1044 and 1045, Vol. 66, No. 25. The machines shown in Figs. 3 and 6, for drilling Chrysler cylinder blocks, are Greenlee machines.

NEWS OF THE WEEK

Deutsches Museum, in Munich, Shows Engineering and Technical Progress

Inspiration to sponsors of American projects

By Edward J. Mehren
Vice-president, McGraw-Hill Publishing Company, Inc.

THERE are now in the United States three projects for technical museums, one for Washington; one for New York, under the Henry R. Towne bequest; one for Chicago, which Julius Rosenwald has offered to finance. Such proposals in the United States are not new, the Towne project having originated before the war. But the schemes have lagged. If, however, our engineers, manufacturers, teachers and public officials could see the famous Deutsches Museum of national science and technology, at Munich, the projects would go forward with speed. Probably the Chicago project will advance rapidly for the South Park Commissioners were here recently as Mr. Rosenwald's guests to study and report on the museum.

This is the third time I have seen this institution—in 1920 in the old building, in 1924 when the exhibits were being moved to the new structure, and now when the installation in the new quarters is complete. Each time the marvel grows, each time one wants to linger longer, to learn, to be inspired.

Try to imagine a single widespread building in which, in models and full-sized operating equipment, one can see and study the machinery, processes, methods and structures of the major branches of engineering and the engineering industries—civil, mechanical, electrical, mining and chemical. That is what the Deutsches Museum contains. Then, as a good engineer should, let one ask that there be added a demonstration of the theory and apparatus of the fundamental sciences, mathematics, physics, chemistry, geology and astronomy. One will not be disappointed. These sciences, too, are well demonstrated and their laws explained.

For good measure, there are added thorough exhibits of ship development, of the airplane and the airship, of paper making, printing, textile manufacturing and farming.

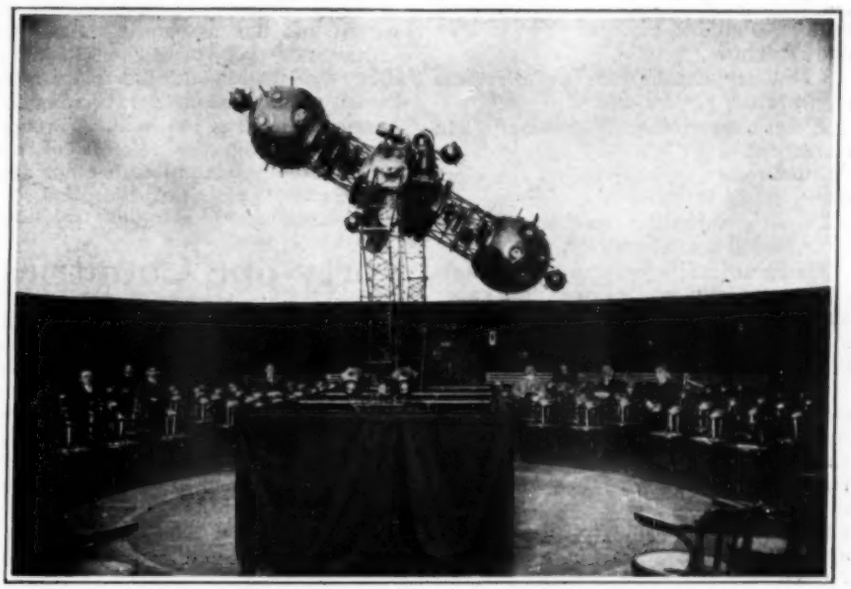
Such is the general picture. As to the divisions, the plan is to show the development of each art or process historically, from its earliest beginnings to its present state. Conspicuously displayed at the entrance to each division is an explanation of the development, so that the visitor before starting his examination is given a key to the understanding of what he will see. On each plan, picture, model or item of equipment there is, in turn, an explanation of its purpose, date and place in the development of the art, while for the many large models of steelworks, gas plants, chemical industries, etc., there are quite intimate explanations of the successive processes or steps in fabrication. Well-informed guides are available, but one hardly needs them; the whole great exhibit tells its own story.

Three points are especially worthy of note. First, the stiffness of a machinery and process exhibit has been relieved by an artistic setting where possible. One comes frequently on large paintings depicting great achievements in engineering and science, canvases sparkling with color, fine examples of the painters art.

Secondly, there are thrills at frequent turnings, when one encounters apparatus with which the giants of science or engineering have made their conquests. Who has not heard of the demonstration of air pressure made before a distinguished company by Von Guericke in 1654, when two teams of eight horses each tried to pull apart two halves of the sphere from which the air had been exhausted. Here are the identical hemispheres, while a large painting, dominating the room, sets forth the historic scene. So it is in many other branches covered by the exhibit; here is the original apparatus with which scientific and engineering history has been made. Often where originals are already deposited in museums, exact reproductions have been made for Munich.

Further, and this is the third noteworthy point, the Museum is not only a museum, but a peoples' laboratory. The visitor himself can perform many of the experiments to demonstrate the fundamental laws of physics and chemistry, and of the elemental machines. In addition, most of the full-sized apparatus is operative, and is demonstrated on request. An "overseer" is provided for this purpose in each section.

Adequate description of the scope of the museum is impossible in short space. The guide book alone contains 360 pages of closely printed matter, the exhibits number 40,000 items, the floor-space (exclusive of large items displayed in the garden) is 430,000 sq.ft., and the length of the route through the exhibits is just 10 miles. It must suffice here to list the divisions and this list will give some idea of the breadth and thoroughness of this great exhibit. There will



The Planetaria in the Deutsches Museum in Munich, Germany

This article was written especially for *American Machinist* by Edward J. Mehren, who is traveling in Europe for the purpose of making industrial surveys of several countries. Other articles will appear in future issues.

be added, in closing, a brief word about the planetaria, in some respects the most surprising feature of the whole installation.

The divisions and sub-divisions of the exhibit are as follows:

Geology, coal, salt and iron mining (with full-sized models of shafts and passage-ways, made from plaster casts in actual mines), mining machinery (much of the equipment of full size and in operation).

Iron and steel making: blast furnaces, bessemer converters, open-hearth and electric furnaces, rolling mills.

Foundry practice and machinery, forging, pressing, machine tools, testing of materials.

Power machinery, driven by air; water and steam, gas and oil.

Heating and ventilation.

Travel and traffic mechanisms, from bicycles, through wagons, automobiles and street cars to locomotives, modern railway cars, the latest steamships and airships.

Tunnel construction, bridges, water supply, sewerage, dams, canals, harbors, building materials and construction, roads and streets, railroad right of way and structures.

Chemistry, chemical and metallurgical engineering, gas making.

Electricity, electrical machinery and equipment.

Illumination, primitive, gas and electric.

Physics, including mechanics, heat, light, sound and electricity.

Mathematical instruments, Astronomy, the textile industry, Agriculture, Paper making, Printing, Farming, Brewing and distillation (American papers please note).

As previously noted, the two planetaria are among the most interesting features of the whole museum. One shows on a reduced scale the actual paths of the planets against a diagram of the zodiac. The other shows the planets and their movements as they appear from the earth. This is accomplished in a darkened room by projecting the heavens on a hemispherical ceiling. Both installations were designed and built by the well known optical firm of Carl Zeiss, of Jena.

The mechanical planetarium shows the planets in their proportionate sizes, the sun, at the center of the system, being an electric light. The planets at properly proportioned distances travel each in their paths and at speeds properly proportioned to each other. Each is accompanied by its satelites, which likewise follow their respective orbits at proportionate distances and speeds. The phenomena of night and day, of the changes in the seasons, of the phases of the moon, "morning stars" and "evening stars," the relation of the axis of the earth's diurnal rotation to the plane of its ecliptic, the position of the moon against the fixed stars and the position of the sun in the zodiac, all become perfectly clear. To make the demonstration still more intelligible a car, beneath the representation of the earth, travels in the earth's orbit, so that the observer on the car can see the relationship of the positions of the earth and of the other planets.

Even more fascinating is the second planetarium. In fact, this type of planetarium has taken hold so strongly in Germany that seven additional installations have been made, in as many leading German cities, under municipal auspices, as part of the educational work in natural science, ranking with public maintenance of museums and botanical and zoological gardens.

Against a hemispherical ceiling are projected the fixed stars; they rise above the horizon and pass across the meridian just as they do on a clear night. Then the planets appear, as the lecturer proceeds with his explanation. The sun rises in its proper position for the day of the lecture. Evidently one cannot wait in the planetarium for 24 hr. to see the phenomena of the natural day; therefore the progress of the heavens is speeded up from a 24-hr.-gait to a complete revolution in 4 minutes.

Then to study the motions of the planets, the diurnal rotation of the heavens is stopped; in other words, we proceed on the assumption that the earth is now not turning on its axis. Then the motion of the planets is speeded up to a complete traverse of the heavens by the sun in 4 min. Through this speeding up the relation of the orbits of the planets to each other and to the sun is made clear.

Since the Munich projector was built a newer machine has been built and installed in the municipal museums. With these machines the whole heavens (of the two hemispheres) can be shown. One can be taken on a meridional journey over the North Pole, down the other side of the earth, crossing the South Pole and returning to the point of beginning. At each latitude, northern and southern, the planets run their courses so that one can see where they appear at any time of the year, be he at the North Pole or the South, the Equator or anywhere in between.

Further, the precession of the equinoxes is provided for in both machines, and one can see how the heavens will appear, from a given place on the earth, 1,000 or 5,000 or 10,000 years from now. The North Pole, be it remembered, shifts in the heavens over a long period, thus changing the position from which we see the fixed stars.

In closing this brief description, it should be added that the Deutsches Museum, like so many other great undertakings, owes it origin and development to one man. Many have helped. German industry has been lavish in gifts of full-sized operating machinery, models and even building materials for the new structure. But the genius and painstaking direction behind it all have been those of Dr. Oskar von Miller, of Munich. He has built a monument to himself, and an example for similar efforts throughout the world.

Forty-one Countries at Chamber Meeting

STOCKHOLM, June 28.—The International Chamber of Commerce began its fourth meeting yesterday with eight hundred and fifty-two delegates from 41 countries present. Removal of trade barriers looms as the dominent topic, first because it is so important for Europe and, second, because the chamber itself initiated the study of this subject which formed the basis of a large part of the work of the recent International Economic Conference in Geneva.

The International Chamber of Commerce proposes to take up the Geneva conclusions. Its approval may be expected because the decisions made at Geneva accord, in the main, with the chamber's own report. Backed by this official approval, the business men attending this meeting can go home and impress their responsible ministers with the need of legislative action to remove economic barriers.

Acting president Sir Alan Anderson pointed out in his opening address that individual governments will not act unless business shows that removal of their own barriers will be best for the national interests. These barriers are not merely tariffs; they include adverse treatment of foreign corporations, obstructions to transportation, prohibition of exports or imports and currency instability.

Other subjects for discussion include patents; transportation by water, railroad and air; arbitration of international commercial disputes; international movements of capital; enforcement of foreign judgments.

America is well represented by one hundred and fifty delegates under the able chairmanship of Owen D. Young. Among the delegates are W. W. Freeman, vice-president, Columbia Gas and Electric Co.; Philip H. Gadsden, vice-president, United Gas Improvement Co.; L. K. Comstock, chairman, L. K. Comstock & Co.; Roy D. Chapin, chairman, Hudson Motor Car Co.; John N. Willys, president, Willys-Overland Co.; Windsor White, chairman of the board, White Motor Co.; Norman H. Davis, of New York; Willis H. Booth, vice-president, Guaranty Trust Co.; John H. Fahey, past president, U. S. Chamber of Commerce; Julius Klein, director, U. S. Bureau of Foreign and Domestic Commerce; Fred I. Kent, vice-president, Bankers Trust Co.; Charles H. MacDowell, president, Armour Fertilizer Works; and William C. Redfield, Redmond & Co.

Special interest attaches to the German delegation. This is the largest of all, in spite of the fact that the Germans are attending for the first time. To help American delegates with definite business objectives in Europe, the United States Department of Commerce has commercial attaches and trade commissioners here from London, Paris, Berlin, Brussels, Rome, Copenhagen, Warsaw, Helsingfors and Riga.

Germany Gains on U. S. in Machinery Exports to the United Kingdom

Easy payment terms versus better tools

DURING recent years there has been considerable change in the trend of imports of machine tools into the United Kingdom. Before the war this trade was almost monopolized by American manufacturers. The machine tools imported from the United States during 1912 and 1913, according to British Customs returns, averaged 89 per cent of the total tonnage and 91 per cent of the total value of such equipment entering the country. Shipments received from Germany during the same period averaged only 3 per cent in both tonnage and value. During 1926, the relative participation of these principal suppliers to the British market was as follows: United States, 34 per cent in tonnage and 60 per cent in value; Germany, 56 per cent in tonnage and 32 per cent in value. Presses, punching and shearing machines, although not strictly machine tools, are not classified separately from machine tools for these years, and are therefore included in the figures for these pre-war periods.

Values About Equal

During the pre-war years 1912 and 1913, the average value of American machine tools entering the United Kingdom was £100 per ton, while the average value of the German was £97. Thus, for all practical purposes, it may be assumed that the German prices were substantially the same as the American, and that the virtual monopoly of the import business prior to the war was due to the greater efficiency of the American product, its reputation, and the superior sales methods employed by American sales representatives.

A considerable development of machinery production took place in Germany during the war, and following the armistice it soon became evident to German manufacturers that strenuous efforts must be made to find increased markets abroad for their products. The radical depreciation of the German mark enabled manufacturers to sell for export at extremely low prices and the United Kingdom afforded a convenient market for their sale, as neither the British nor American makers could meet the prices at which the machinery was offered. In spite of the fact the exchange has now been stabilized in Germany, the German makers are still quoting very low prices.

During 1926 the imports of machine tools from all countries showed an increase, as compared with 1913, of 50 per cent in tonnage and 112 per cent in value. The gains indicated, especially as regards to tonnage, would be much larger were it possible to exclude from the 1913 figures certain items which should not be classified as machine tools.

Since 1913, imports from the United States have increased in value from 1,324,823 to 1,455,040, in the face of a drop in tonnage from 3,411 tons to 1,962 tons. This substantial gain in the value of the American equipment entering the United Kingdom, despite a radical reduction in tonnage, is explained by the greatly increased price per ton of the American product, which has risen from an average of £95 per ton in 1913 to £232 per ton in 1926. As the customs returns cover all machine tools imported from the United States and include a considerable number of second-hand machines, the price per ton of the new American equipment was even higher than the returns indicate. The fact that the American product is commanding such an enhanced price in the face of increased competition clearly indicates its high quality as well as the fact that American sales are being more and more confined to the high-production type of machinery.

The gain in imports of American machine tools was largely because of the increased sale of high-production machines, due to the adoption of better production methods on the part of British industrial companies, and it is in high-production machines that the United States holds the lead. This was particularly true of the automobile manufacturers, who have been modernizing their works and equipping them for production on a basis which should enable them not only to hold their home markets, but also to compete with American manufacturers in the Colonial and other markets abroad. For the time being, German machine tool makers are apparently able to undersell both British and American makers of simple tools, and are monopolizing this part of the market. Apart from being willing to quote extremely low prices, the German manufacturers are also willing to send their machines to dealers in Great Britain on consignment, and do not demand payment until the dealer disposes of the machines.

An investigation of the British market shows that Germany is now making simple machine tools such as lathes, planers, shapers and even milling machines, at prices with which neither British nor American manufacturers can possibly compete. Dealers in American tools have practically made it a rule to pay for the machinery on arrival, and carry it in their warehouses until sales are made. It is a significant fact that during the past six years the dealers in American machine tools have experienced great difficulty in disposing of the simpler types, because of German competition in this field—in fact, many of the machine tools in this class which were purchased four or five years ago are still in stock exciting sale.

Fortunately for American manufacturers, neither British nor German makers have been able to duplicate their high-production machine tools. British industry has seen some revolutionary changes lately, and the frequent visits of British investigators to the United States have had at least one great advantage for American machine tool manufacturers, in that these visitors have all returned impressed with the efficiency of American methods of production, and have strongly advocated the adoption of improved methods and the use of more efficient machinery by British industrial companies. It is accordingly in the field of high-production machinery that the American equipment now holds the lead, and this will explain why American machines were sold in 1926 at an average price of £232 per ton, as compared with £74 per ton for German machines.

Industrial Machinery Exports Increase

Shipments of industrial machinery from the United States during May, although representing a decrease of more than $2,000,000 from those of the record month of April, showed an increase of nearly $3,000,000 over May, 1926, according to the industrial machinery division of the Department of Commerce. The actual figures for these periods are as follows: May, 1927, $15,103,000; May, 1926, $12,249,000; April, 1927, $17,338,727.

Exports during the months of April and May of the present year exceed those for any month since 1921. Shipments during the five months ending May, 1927, amount to $73,537,000, as compared with $65,140,000 for the corresponding period of 1926, a gain of more than $8,000,000.

Both oil-well and metal working machinery have shown marked gains during the current year. Shipments of oil-well machinery during the five months period ending in May amounted to $8,798,000, as compared with $6,211,000 for the corresponding period of 1926. During the same periods exports of metal working machinery have grown from $7,880,000 to $9,144,000.

Aircraft Exports

Exports of air craft, airplane engines and parts other than tires from the United States totaled $444,113 during the first four months of 1927, compared with $253,352 in 1926, an increase of 75 per cent, according to the automotive division of the Department of Commerce. In view of the recent favorable advertising which American aircraft products have received it is logical to believe that American exports will continue to increase in 1927.

The firm of William Whiteley, Ltd., London, is advertising for sale on the installment plan De Haviland "Moths," light 60-hp. sport planes, according to the Department of Commerce.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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IT OFTEN happens that a change in the trend of the speculative markets is caused by an incident that is comparatively trivial in itself. This was the case in the spring of 1920 when the "Overall Parade" focussed attention upon the high cost of living and led to the so-called "buyers' strike" that ushered in a period of distressful deflation. It is too early to speak positively, and conditions are not identical, but it is possible that the reduction in the pay of the moving picture employees that was recently announced may have a similar effect.

The incident has called attention to the fact that we cannot go on raising wages and increasing our expenditures indefinitely. It may be the precursor of a thrift movement that will find expression in a lessened expenditure for amusements, travel, and the many other non-essentials for which the people of America spend so lavishly. That such a thrift movement would be salutary, nearly everyone will admit, but the fact that it would reduce earnings in many lines of business must also be admitted, and this is the interpretation it seems to have been given in the stock market, where an orderly liquidation at a gradual decline has been in progress most of the week.

A substantial reaction in security prices has been due for some time, and its belated arrival should surprise no one. It may reduce the paper profits of those who are carrying stocks on margin but it will not work much harm otherwise, and it will release a substantial portion of the bank credit that has been employed to carry stocks and some of the undigested and undistributed bond issues recently brought out. A reduction of $44,000,000 in brokers' loans was, reported by the Federal Reserve Banks last Monday, and a further contraction seems to be indicated, as call money has loaned as high as 5 per cent during the week, and the banks seem disinclined to increase their security loans despite the high reserve ratios and large gold holdings reported by the Federal Reserve institutions. There is, in fact, a feeling that the Federal Reserve authorities are disposed to conserve the gold under their control with a view to the time when Europe will be able to recapture it by raising rates or otherwise. The presence in New York of representatives of the Bank of England, the Bank of France, and the German Reichsbank, who have come here to confer with our own Federal Reserve officials, gives currency to this idea, and has effectively negatived the theory that we are entering a period of gold inflation.

Insofar as general business is concerned, all the available indicia bespeak a turnover that is slightly under last year's. The business in cotton goods is perhaps an exception, as the turnover is still large and most of the Southern cotton mills appear to be well employed. But it is to be observed that staple fabrics are not much higher than they were when cotton was appreciably lower, and some merchants are reported to be buying print cloths and selling cotton futures against them at a wider margin than has been obtainable for months.

The woes of the woolen industry are being widely advertised, and the appointment of a trade "Czar" who will have what may be described as a "moral control over prices" is being seriously advocated. The "Czar idea" has, indeed, been gaining ever since Judge Landis was made "Imperator" of the baseball industry and Will Hays was designated as the Dictator of the movie business. Many of the oil producing companies are urging that a Czar should be appointed to control the overproduction for which the Seminole field is primarily responsible. Even the New York taxicab owners are clamoring for a Czar who will be empowered to raise rates, and the railroads as well as the "bus" lines of the country are volunteering to put themselves under the direction of overlords who will have plenary power to represent them before the Interstate Commerce Commission and the transportation commissions of the various states. Aside from their legality, which remains to be determined, the chief interest of these various proposals lies in the fact that they connote overproduction which must be controlled in order to prevent depression.

Each week this overproduction is becoming apparent in new quarters. An example of it is to be found in the Baldwin Locomotive Works, where operations have been curtailed, as well as at Detroit, where the unemployment is increasing, and in the soft coal mines, where an extensive shut-down has been ordered despite the reduced output already due to the strike

The steel industry is less active, and a further contraction is reported, largely because consumers seem unwilling or unable to buy in quantity. The market for crude rubber is again lower, and the *London Mail* suggests that each shareholder in the rubber producing companies should purchase 100 lb. to help stabilize a weak market. Coffee continues to droop on the expectation of a big crop. Sugar, though statistically strong, has been speculatively slow, and the market is no higher.

WHAT'S DOING IN INDUSTRY

THE ACTUAL arrival of the summer months brings the anticipated slump in sales activity in the machinery and machine tool trade. The volume for June was up to expectations in most industrial centers, although the uncertainty in the automobile industry is being felt throughout the trade.

DETROIT is still inactive, awaiting developments. A few good orders have been placed by Ford, but no general activity is reported. Chicago did well in June with some railroad buying, but summer prospects are not promising. Sales are scattered in the Cincinnati district, and quiet pervades Milwaukee with future prospects only fair.

NEW YORK dealers did a fair business in June but inquiries do not indicate an increase in July. New England has slowed down temporarily, but there is much in prospect. Conditions are slightly better in the Buffalo territory, and Philadelphia reports good prospects from public utility and construction projects.

FIGURES just released by the Department of Commerce show a $3,000,000 increase in value of exports of industrial machinery from the United States in May, 1927, over May, 1926. The report also states that April and May of this year exceeded any previous months since 1921. Metal working equipment showed a marked gain.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

PHILADELPHIA

Some inquiries from the automotive trade and a few orders from public utility corporations, featured the Philadelphia market during the last two weeks. Some of them indicate orders will soon be placed, but generally speaking the market continued the dullness which has characterized it during the last few months.

A dealer in leather belting for industrial plants reported some activity in buying at a slight advance in prices from general industrialists, but the purchases were for necessary replacements and did not portend quantity buying of importance. What railroad inquiries have been made were of the conservative type, indicating only necessary purchases are in anticipation. There is a belief among leaders of the industry that the present condition is due to the usual seasonal declines.

Public work is progressing satisfactorily. The city has $25,000,000 available to complete the second leg of the Broad Street Subway, bids for which will be opened July 19, and earlier in the month bids will be opened for equipping the repair shops for the new subway.

MILWAUKEE

Sales of machinery are generally reported as quiet, with no outstanding orders being placed to relieve the monotony of single-item bookings. Prospects for July are considered only fair, as inquiry has been lagging for some time past, and conditions promise no substantial improvement until the summer period comes to a close. The state of the automobile industry is such that the slow buying of recent months probably will be the rule for two or three months more. The railroads have done little in the way of buying, but are expected to be more profitable customers in the future.

Replacement business remains the dominating factor in machinery trade. Urgent necessities appear to govern buying in virtually every line of the metal working industry. Shops as a rule are well occupied with work, but with few exceptions there is no pressing need of more capacity which would call for large lot purchases of equipment. The volume of industrial construction has been declining steadily, giving the machinery trade fewer opportunities for sales.

CHICAGO

With the advent of the warm months, the calling in of many salesmen, and the departure of many executives on vacations, the machine tool industry seems to have lapsed into a condition where business is practically negligible. The month of June has been one of the most unsatisfactory experienced in recent years, from a trade standpoint. Railroad buying has constituted the chief factor in such business as has been done for the last three months, but with railroad lists now almost entirely closed, and with no new business from this source in sight, the outlook is not encouraging for the near future. Inquiries from general industry continue to be received in fair number, but the closing of sales is a slow and tedious process.

In certain lines of machinery there is some exception to the general rule. Manufacturers of grinding machines and abrasives state that while there is a slight falling off from spring business, due to reduced production in the automotive industry, trade on the whole is well maintained. Manufacturers of saws of various types for metal working and wood working plants report fairly active conditions. In some lines of heavy-duty tools, producing plants have held to their regular scale of output with future business in prospect.

NEW ENGLAND

Judged from the number of machinery and metal working plants closing at this season of the year, and the duration of shutdowns for inventory and repairs, business in New England has slowed down to some extent. Probably 6 per cent more plants are closing than closed at this season last year, but the length of the closed period is substantially the same as a year ago. Estimates made in scattered sections are that at this time the volume of business in production is 8 per cent less than at the same time last year. A feeling of optimism prevails, however, and the foundation for that feeling is the amount of business in prospect and, generally speaking, all look forward to the remaining six months to make up any slight difference that now exists when the records are compared.

Special machinery builders report a substantial amount of business already contracted for. In some cases present orders will carry well into next year, and other business is available whenever manufacturers are ready to accept the orders.

CLEVELAND

The feature of the machinery business for the past ten days was the continued improvement in the automatic line. This division is showing a small but steady gain. June sales showed an increase over May. New inquiries are increasing and a more encouraging tone predominates. Manufacturers of forgings and boring mills report business as being a shade better.

A spotty condition prevails in the remaining branches of the industry. Selling agents report business as being slow. Orders are confined to single tools. The sales chart for the second quarter of the year is on a par with the first quarter. Business for the first half of the year was hardly up to expectations.

BUFFALO

A welcome but unexpected turn in the activity of the machine tool market in Buffalo has developed within the last two weeks. Nearly all dealers report a definite increase in the number of inquiries regarding future purchases of equipment and several report a greater volume of sales, indicating that June will probably be a better month than May when the final reports are in.

While this may be merely a spurt of business and interest without any material significance, the wise heads in the business here who have had years of experience under local conditions do not seem to think so. Some of them will be surprised if there is not an active market during July and August, though it would be contrary to the usual conditions.

Conditions in the electrical equipment field reflect the slight increase in activity in the machine tool field. All considered, conditions here are better than they have been in two or three months.

NEW YORK

The volume of business placed in this market in June was not as unfavorable as many had expected. When the final count was made, it was found that the total was in many cases ahead of that of May, and generally speaking the trade is optimistic. Uncertainty and conservatism still persist, giving the impression that business is slow, but the returns show a satisfactory trend.

The number of inquiries has fallen away below normal for this time of the year. Calls for one or two pieces are coming in, but no sizable lists have been issued by any of the large industrials, railroads or contractors.

Used tools in good condition continue to find a market when offered at an attractive price. Standard machines make up the bulk of this business.

July usually begins the summer slump in machinery sales, and the prospects for the coming season are not unlike other years. Any increase in business would seem to depend on a boom in automobile building.

CINCINNATI

Taking everything into consideration, the majority of the machine tool manufacturers and selling agents in the Cincinnati district regard the past six months' business as fairly satisfactory. There was a lull at times, but this was of short duration and did not affect the period.

Nine tools were ordered by the Santa Fé R.R. from its current list of requirements and it is thought that additional purchases from the list will be made in the near future. Purchases from the automotive field were confined to single tools and replacements.

Manufacturers find considerable encouragement in the fact that export inquiries are beginning to come in, some having been received from Germany, Spain and countries in South America. There was also a fair-sized inquiry from Hawaii.

A number of domestic inquiries were received during the week, but they were confined mostly to requests for information about tools for replacements.

DETROIT

This is a vacation period for Detroit as far as the machinery and machine tool industry is concerned. There is little activity and though this condition has existed in a greater or lesser degree for several weeks the dealers here have not taken a pessimistic attitude. There is still a general feeling of expectation that seems largely based on the anticipation of the new Ford car. That this has had a marked influence on the machinery market is everywhere indicated. Motor car manufacturers are reluctant to place orders, body companies are holding back and the entire army of parts makers and small shops are waiting for the new and long expected product.

The present slump is more pronounced than any that have struck the Detroit district in many years, but there is a general belief that the year as a whole will be as good or perhaps better than the average.

Exhibitors Announced for New Haven Show

The committee of arrangements has announced the following list of exhibitors for the seventh annual machine tool exposition to be held Sept. 6 to 9 at the Mason Laboratory, Yale University, New Haven. The show is held under the joint auspices of the New Haven Section of the A.S.M.E., the department of mechanical engineering of Sheffield Scientific School, and the New Haven Chamber of Commerce.

The latest list includes:

Air Reduction Sales Co., New York, G. Van Alstyne.

Bausch & Lomb Optical Co., Rochester, N. Y., Max Poser.

E. W. Bliss Co., Brooklyn, F. D. Beattie.

Botwinik Bros., New Haven, Conn., Hyman Botwinik.

Bristol Co., Waterbury, Conn., J. B. Kelsey.

Buffalo Forge Co., Buffalo, N. Y., E. G. Leonard.

Bullard Machine Tool Co., Bridgeport, Conn., E. T. Blanchard.

Clipper Belt Lacer, Grand Rapids, Mich., Fred E. Best.

C. J. Dickgiesser, Derby, Conn., C. J. Dickgiesser.

Divine Bros. Co., Utica, N. Y., H. E. Boardman.

Eastern Machine Screw Corporation, New Haven, Conn., F. J. O'Rourke.

Fafnir Bearing Co., New Britain, Conn., R. N. Hemmenway, Asst. Sec.

General Electric Co., Schenectady, N. Y., R. H. Van Horn.

Geometric Tool Co., New Haven, Conn., G. A. Denison.

Goss & DeLeeuw, New Britain, Conn., S. T. Goss.

Keller Mechanical Engraving Corporation, Brooklyn, Jules Dierckx.

Machinery Dealers' Corporation, New Haven, Conn., C. C. Sibley.

Manning, Maxwell & Moore, New York, A. W. Clem.

National Acme Co., Cleveland, Ohio, A. E. Henn.

New Britain Machine Co., New Britain, Conn., E. L. Steinle.

New Departure Manufacturing Co., Bristol, Conn., C. F. Olin.

New Haven Gas Light Co., New Haven, Conn., J. A. Norcross.

Noble & Westbrook Manufacturing Co., Hartford, Conn., W. C. Westbrook.

O. K. Tool Co., Shelton, Conn., F. J. Wilson.

N. W. Ordway & Son, Hartford, Conn., N. W. Ordway.

Oxweld Acetylene Co., Long Island City, N. Y., Z. Davis.

Pneumatic Drop Hammer Co., Boston, Mass., W. H. J. Fitzgerald.

Potter & Johnston Machine Co., Pawtucket, R. I., W. W. Potter.

Pratt & Whitney Co., Hartford, Conn., C. R. Burt.

Purinton & Smith, Hartford, Conn., L. A. Smith.

Racine Tool and Machine Co., Racine, Wis., M. E. Erskine.

S. K. F. Industries, Inc., New York, Wm. Jetter.

Standard Machinery Co., Auburn, R. I., J. H. Connolly.

Timken Roller Bearing Co., Canton, Ohio, R. P. Kelley.

Torrington Co., Torrington, Conn., J. W. Blackford.

Triplex Machine Tool Co., New York, John Cetrule.

Penn Pump & Compressor Co., Easton, Penn., W. C. Peck.

Jones and Lamson Machine Co., Springfield, Vt., H. S. Beal.

Steel Industry in Canada Made Gain in 1926

Production of iron and steel and their products in Canada during 1926 amounted in value to $496,376,260, marking an increase of 23 per cent over the total for 1925, and a higher output value than in any other year since 1920, according to a report just issued by the Dominion Bureau of Statistics. The operating capital at $592,134,860 was 4 per cent higher than in the previous year; the number of employees was 101,414, as against 90,125 in 1925. Purchased materials used in manufacturing cost $254,385,738 and as the finished products sold for $496,376,260 the value added by manufacturing was $241,990,522, or 95 per cent of the original cost.

All groups showed gains in the sales value of production in 1926, ranging from seven thousand dollars in the bicycle industry to twenty-three millions in the automobile industry. By groups, the percentage gain in values of output were: Railway rolling stock, a gain of 37 per cent, to $72,460,962; industrial, household and office machinery, an increase of 26 per cent, to $38,369,454; boilers, tanks and engines 17 per cent, to $5,320,685; castings and forgings 10 per cent, to $68,207,976; agricultural implements and machinery a gain of 29 per cent, to $31,913,734; primary iron and steel industry, including pig iron, steel ingots, direct steel castings, and rolled products, an increase of 17 per cent, to $41,257,070; sheet metal goods a gain of 14 per cent, to $39,190,724; hardware and tools 27 per cent, to $22,648,667; auto parts and accessories 24 per cent, to $13,919,379; iron and steel fabrication 21 per cent, to $11,378,851; wire and wire goods about 3 per cent, to $16,657,865. The automobile industry advanced 21 per cent to $133,598,456, and the bicycle industry also showed a gain.

Additions to Faculty

Five new faculty appointments to the college of engineering are announced for next year by the Carnegie Institute of Technology. They include John H. Neelley, as associate professor of mathematics; Howard V. Russell, as assistant professor of physics; Walter H. J. Taylor, as assistant professor of chemical engineering; Charles E. Leberknight, as instructor of physics; and John A. Davis, as instructor of civil engineering.

Standards Adopted for Automobile Builders

Twenty reports by divisions of the standards committee of the Society of Automotive Engineers recommending new standards or changes in existing ones were approved at a meeting of the standards committee and the council of the society at the recent meeting. At the business session the members voted to submit the report to a letter ballot of all of the voting members so that the new standards can be included in the September issue of the S.A.E. Handbook of standards and recommended practices.

The new specifications relate to roller bearings, automobile wiring, instrument mountings and connections, dome light lamp brackets, passenger car body lighting switches, heat treatment definitions, steel specifications, the numbering of steels, motor vehicle turning radius, bumpers, bushings, rivets, flexible couplings, and taps.

A proposed definition of the turning radius of an automotive vehicle is that it is the radius of the arc described by the center of the track made by the outside front wheel of the vehicle when making its shortest turn.

Of greatest popular interest is the proposed standardization of passenger car, small motorcoach and light delivery car bumpers at a height of 18 in. above the ground at the front and 19 in. above the ground at the rear, so that bumpers will not interlock but the faces of the bumpers on two vehicles will meet when the vehicles come together. The overall length of both front and rear bumpers on passenger cars is specified as 60 in., and the vertical depth of the faces is specified as 2 in.

Another subject of interest to car owners is the proposed standardization of distinctive colors for the covering of all wires in the electrical system so that each can be distinguished readily and followed throughout its length in the chassis.

Auto Engineers Invited to British Exposition

An invitation to visit the next World Motor Transport Congress, to be held in London, Nov. 14 and 16, and the International Motor Transport Exhibition in London from Nov. 17 to 26, has been extended to members of the Society of Automotive Engineers in this country by the Society of Motor Manufacturers and Traders of Great Britain and the Institution of Automobile Engineers, of England.

The main object of the congress is to secure discussion calculated to stimulate action by government and other bodies in furtherance of highway motor transport development throughout the world. During the commerical motor transport exhibition conferences are to be held on the subject of railroad terminal services, retail store distribution, and the functions of motorcoaches and electric railways.

Personals

ALFRED D. FLYNN, director of the Engineering Foundation, was awarded the degree of Doctor of Science at the celebration of the five-hundredth anniversary of the University of Louvain.

L. R. WILDER has resigned as president of the American Brown Boveri Electric Corporation, of New York, to become chairman of the advisory committee of the organization.

ERNEST R. STANDFUSS, works manager of the Harnischfeger Corporation, Milwaukee, formerly the Pawling & Harnischfeger Co., has been elected a vice-president of the company. Mr. Standfuss went to the Harnischfeger plant as works manager in 1920, following a period of eight years as general superintendent of the Clyde Iron Works Co., Duluth, Minn.

J. WALTER DRAKE, of Detroit, Mich., assistant secretary of commerce since June, 1923, is planning to return to business in the early fall. Assistant Secretary Drake has been anxious to reenter business life for a long time, but has delayed from time to time at Secretary Hoover's request. Up to the time Mr. Drake became assistant secretary of commerce he was chairman of the board of the Hupp Motor Car Corporation, of which he was one of the organizers.

Business Items

The Chicago Pneumatic Tool Co., of New York, announces the removal of its St. Louis office, service department and warehouse from 813 Hempstead St., to 1931 Washington Ave., in St. Louis.

The Cadillac Machinery Co., of 6209 Hamilton Ave., Detroit, has been appointed sales representative in the Detroit territory for the W. F. and John Barnes Co., of Rockford, Ill., manufacturer of machine tools.

The Palmgren Stapling Devices, Inc., 8389 South Chicago Ave., Chicago, has been formed and will manufacture and deal in machinery, tools, mechanical devices and equipment.

The Eagle Manufacturing Co., 4518-20 Fullerton Ave., Chicago, has been organized to manufacture and deal in metal, wood, or other materials, implements, tools, fixtures, and machinery.

The Brown-Craven Equipment Co. was organized recently at Chattanooga, Tenn., and has established offices and sales rooms at 706 N. Manning St., in North Chattanooga, for the distribution in the Southeastern area of used and rebuilt machinery and machine tools.

The Appleton-Wisconsin Co., South Milwaukee, Wis., formerly the Stowell Co., manufacturer of malleable castings, hardware, etc., has placed a contract with the Austin Co., Cleveland, for the erection of three new buildings—an annealing shop, a soft cleaning room and a foundry unit.

The Industrial Electric and Machine Co. has opened a new plant at High Point, N. C., for the manufacture of various types of machinery for use in manufacturing plants, including railway and woodworking equipment, it is announced by F. J. Bartlett, head of the company.

The Trane Co., La Crosse, Wis., manufacturers of steam specialties and unit heaters, announces the recent opening of a new Southern branch in Atlanta at 608 Bona Allen Bldg., to handle the company's trade in the Georgia and Alabama district, Floyd E. Baird, of Atlanta, is in charge of the branch as district manager.

The Consolidated Concrete Machinery Corporation has been organized at Adrian, Mich., the new company being a merger of the following firms: The Anchor Concrete Machinery Co., Adrian, Mich.; Ideal Concrete Machinery Co., Cincinnati; Thomas W. Noble & Co., Chicago; Universal Tamping Machinery Co., Peoria, Ill.; and Adrian Casting Co., Adrian. F. Olsen is president and general manager and J. W. Freiberg is chairman of the board. G. F. Alderdice is vice-president.

The Whiting Corporation, of Harvey, Ill., announces the appointment of the following sales representatives: The Eichman Machinery Co., Kansas City, Mo.; the Huey & Philp Hardware Co., Dallas, Texas; L. H. Staley, New Orleans, La.; and H. B. Wilson, St. Louis, Mo., with the addition of Arkansas.

The amalgamation of the sales forces of the National Machinery Co., of Tiffin, Ohio, with those of the Chambersburg Engineering Co., of Chambersburg, Pa., has been completed. The Chambersburg company manufactures a line of forging and pressing machinery, while the National company manufactures forging machines and a line of bolt and nut machinery. The two lines do not conflict but augment each other. The unification of the two sales forces was inaugurated for the purpose of offering a complete service on related equipment. Outside of the amalgamation of selling forces, the two companies will remain as distinct and separate organizations, there being no change in ownership, management or personnel. Sales offices will be maintained in Tiffin, Chambersburg, New York, Chicago and Detroit.

S.A.E. Nominations

William G. Wall, consulting engineer, of Indianapolis and now first vice-president of the Society of Automotive Engineers, has been nominated for president to serve for the year 1928. The election of officers for next year does not occur until the annual dinner, to be held in New York next January. Other nominations made are as follows:

First vice-president—W. R. Strickland, assistant chief engineer, Cadillac Motor Car Co.

Second vice-president, representing motor car engineering—Dr. H. C. Dickinson, physicist, United States Bureau of Standards.

Second vice-president, representing tractor engineering—D. F. Davies, vice-president, J. I. Case Threshing Machine Co.

Second vice-president, representing aviation engineering—L. M. Woolson, aeronautical research engineer, Packard Motor Car Co.

Second vice-president, representing marine engineering—Harry T. Woolson, chief engineer, Chrysler Corporation.

Second vice-president, representing stationary internal-combustion engineering—C. R. Schuler, sales engineer, Hercules Motor Co.

Treasurer—C. B. Whittelsey, president Hartford Rubber Works Co.

Councilors to serve two years—E. W. Templin, chief engineer, Six Wheel Co.; J. W. White, chief engineer, Wire Wheel Corporation, and F. G. Whittington, chief engineer Stewart-Warner Speedometer Co.

Obituaries

HENRY P. TALBOT, dean of Massachusetts Institute of Technology, died at West Newton, Mass., on June 18.

JAMES W. BROWN, vice-president of the Western Machine Co., of Milwaukee, died on June 19.

C. W. BRYAN, chief engineer of the American Bridge Co., of New York, died at New Rochelle, N. Y., on June 25. He was a member of the American Society of Civil Engineers, and the American Iron and Steel Institute.

Break in Movement of Cost of Living

The first break in the steady and rather rapid, downward movement of the cost of living in the United States, which has taken place since December, 1926, occurred in April, 1927, when the index for that month remained the same as for the previous month, namely 163.7. The total decline for the first five months in 1927 was much more marked than the decline for the same period in 1926. In May, 1927, the index of the cost of living was 2.0 per cent lower than in January; while in May, 1926, the index was only 1.4 per cent lower. The reduction for the year May, 1926, to May, 1927, was 2.6 per cent.

Except for the index of the retail prices of food the other items of the budget, shelter, fuel and clothing continued to show the downward tendency. But on account of the great weight food has in the budget the increase of 0.6 per cent counterbalanced the other decreases, causing the total index number of the cost of living to show no change. Out of the 179 cities reporting for rents, the majority showed no change, 36 revealed recessions in May from April, and only eight had increases.

This month there was an advance of 1.1 per cent in cotton yard goods, but the rise was not reflected in the cotton apparel, all the prices of which declined in May from April. As a result the clothing index receded. In the case of woolen goods, the prices of yard goods declined, together with a decline in wearing apparel, except for women's suits and coats which advanced. The purchasing value of the dollar based on the cost of living was 61.1 in May, 1927, as compared with $1 in July, 1914.

Forthcoming Meetings

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, Pennsylvania Bldg., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Building, Cincinnati, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

PRICES of the principal hot-rolled steel products are from 5 to 10c. per 100 lb. under quotations of a month ago at Pittsburgh mills. Despite more than seasonal dullness in the iron and steel market generally, there is marked firmness in prices of sheets and wire products due to improvement in demand. Sustained buying is also apparent in tank plates; agricultural implement requirements are increasingly larger. Beneath the whole structure of prices covering shop materials and supplies in the metal-working industries, lies a dull pig-iron market. The present slow-down in tin plate is seasonal; demand for automotive materials is not unduly sluggish. Fabricated brass and copper are down ¼c. per lb.; scrap copper is off about ⅛c. in the New York market this week. Linseed oil dropped to 87c. per 7½-lb. gal. (5-bbl. lots) f.o.b. New York and Chicago.

(*All prices as of July* 1)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18 50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	27 17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25	3.50	3.25	3.89
No. 12	2.30	3 55	3.30	3.94
No. 14	2 35	3.60	3.35	3.99
No. 16	2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.80	3.75	3.75	4 00
No. 22	2.95	3.90	3.90	4 15
No. 24	3 00	3.95	3.95	4.20
No. 26	3 10	4.05	4.05	4.30
No. 28	3 25	4 20	4.20	4.45
Galvanized				
No. 10	3 15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4 35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4 65	4.95
No. 26	4.05	5.05	4.90	5 20
No 28	4.30	5.30	5.15	5 45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6 25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3 99	3.20	3.65
Tank plates (base)	3 34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛″, 8.35c.; ¼, 7.85c.; ⅜″ to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic, up to carlots, New York			13.75
Tin, pigs, 5-ton lots, New York			67.87½
Lead, pigs, up to carlots, E. St. Louis	6.15	New York	7.00
Zinc, slabs, up to carlots, E. St. Louis	6.22½	New York	7.12½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	15.00	17.50	13.00
Copper sheets, base	21.25	21.50	21.25
Copper wire, base	18.00	18.25	14.50
Copper bars, base	20.75	21.25	20.75
Copper tubing, base	23.25	24.25	23.25
Brass sheets, high, base	17.50	17.75	17.50
Brass tubing, high, base	22.37½	22.62½	22.37½
Brass rods, high, base	15.25	15.62½	15.25
Brass wire, high, base	18.00	18.25	18.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.00	11.30	10.11
Solder (⅛ and ¼), (case lots)	41.00	42.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	86.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	13.00

Nickel, f.o.b. refinery, cents per lb.:
Ingots..... 35.00 Electrolytic.. 39.00 Shot.....36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00 @11.25	10.50	9.75@10.25
Copper, heavy, and wire	10.25 @10.75	10.50	9.00@ 9.50
Copper, light, and bottoms	9.00 @ 9.50	9.00	8.00@ 8.50
Heavy lead	5.00 @ 5.50	5.25	4.50@ 5.00
Tea lead	4.25 @ 4.50	3.25	3.00@ 3.50
Brass, heavy, yellow	7.00 @ 7.50	6.75	6.50@ 7.00
Brass, heavy, red	8.75 @ 9.00	9.25	8.50@ 9.00
Brass, light	5.00 @ 5.50	6.00	5.50@ 6.00
No. 1 yellow rod turnings	7.25 @ 7.50	7.00	6.50@ 7.00
Zinc	3.75 @ 4.00	3.00	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36.00 per M	15
Sal soda, per lb	02½	02	02¾
Roll sulphur, per lb	.02¾	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.87	99	87
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	65	50	50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.33	35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.1525	.155	.1662½
Solder (½ and ¼)	per lb.	.41	.4075	.3912½
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.65	.55	.55
Machine oil	per gal.	.33	33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton	Connellsville,		3.00@3.25
Coke, prompt foundry, per net ton	Connellsville,		4.25@4.75
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in.	50%	50–10%
Larger up to 1 x 30-in.	45%	50%
1⅛ and 1¼ in. dia.	30%	35%
Carriage bolts:		
Up to ½ x 6-in.	50–10%	.....
Larger sizes	50%	.....
Coach and lag screws:		
Up to ½ x 6-in.	50–10%	.....
Larger sizes	50%	.....
Tap bolts, hexagonal heads	45%	.....
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	.....
Case hardened, hexagonal, tapped, in packages	30%	.....
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including 7/16-in. dia.	.....	50–10%
Large (base) per 100 lb.	$6.50	$5.00

EXTRA per 100 lb. on rivets, for ½-in. dia., 35c.; ⅝-in., 15c.; 1-in., 5c.; length 1-in. and shorter, 25c.; longer than 1-in. up to and including 1½-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

Ala., Sayreton—The Republic Iron & Steel Co., Woodward Bldg., Birmingham—additional machinery and equipment for company's mines here to cost $250,000.

Fla., Jacksonville—Standard Mfg. & Engineering Corp., Box 553—machinery and equipment for proposed machine shop.

Mass., Chelsea (Boston P. O.)—Union Motor Sales Co., 40 Fourth St.—miscellaneous tools and equipment for proposed 1 and 2 story repair and service garage. Estimated cost $40,000.

O., Toledo—Toledo Wire & Iron Co., 1200 Locust St.—one 5 to 10 ton gasoline crane, 35 to 40 ft. boom, capacity not less than 3,000 lb. at 35 ft., structural shape handling.

O., Youngstown — Valley Machine Co., 2310 Oakhill Ave.—one 48 x 30 ft. lathe. Incorrectly noted under Cleveland, June 23 issue.

Ont., Rockland—Canadian International Paper Co. Ltd., 355 Beaver Hall Sq., Montreal, Que.—complete equipment for proposed saw mill to replace fire loss here. Estimated cost $130,000.

Que., Montreal—P. Chartrand, 4356 Breboeuf St.—complete equipment for proposed garage and repair shop.

Opportunities for Future Business

Ala., Birmingham—Birmingham National Garage, Inc., E. S. Moore, Pres., 2028½ First Ave. will soon receive bids for the construction of a 7 story garage. Estimated cost $750,000. Warren, Knight & Davis, Empire Bldg., Archts.

Calif., Long Beach—Ford Motor Co., B. R. Brown, Ch. Field Engr., Highland Park, Mich., will receive bids until July 15 for the construction of a 1 story, 390 x 928 ft. assembly plant here. Estimated cost $5,000,000. A. Kahn, c/o owner, Archt.

Calif., Glendora — California Novelty Chair Co., c/o Sedgley & Erskine, Kerckhoff Bldg., Los Angeles, Archts., is having plans prepared for the construction of a 1 story factory here.

Calif., Manteca — Manteca Union High School Dist. is receiving bids for the construction 1 story, 50 x 80 ft. shop including woodworking department, farm mechanics department, etc. Davis-Pearce Co., Builders Bldg., Archt.

Calif., Santa Rosa—Santa Rosa Union High School Dist., is receiving bids for the construction of manual training shops. Estimated cost $25,000. W. Herbert, Rosenberg Bldg., Archt. Noted Jun. 16.

Calif., Stockton—Dodge Bros. Motors Co., Graham Truck Division Plant, R. L. Houston Mgr., is having preliminary plans prepared for the construction of a 90 x 500 ft. addition to truck shop.

Conn., Hartford—Arrow Electric Co., 103 Hawthorne St., awarded contract for the construction of a 1 story, 62 x 500 ft. factory on Capital St. Estimated cost $125,000. Noted June 30.

Ill., Chicago—Arrow Machine Co., 1624 North Kilbourn Ave., awarded contract for the construction of a 1 story, 33 x 125 ft. shop.

Ill., Chicago — Wisconsin Steel Works, 2701 East 106th St., awarded contract for the construction of a 1 story, 65 x 94 ft. factory on East 208th St. Estimated cost $18,000.

Ill., Waukegan — Johnson Motor Co., awarded contract for the construction of a 1 story, 300 x 360 ft. plant. Estimated cost $200,000.

Ind., Indianapolis—Thornton & Rodecker, 658 Fairfield Ave., are preparing plans for the construction of a 9 story repair and service garage. Estimated cost $300,000.

Ind., Mishawaka—The DeRhodes-Yerrick Motor Co., 222 North Lafayette St., South Bend, awarded contract for the construction of a 1 story, 66 x 135 ft. repair and service garage here. Estimated cost $70,000.

Ia., Sioux City—Albertson & Co., 3100 Floyd Ave., manufacturers of valve grinders, will soon receive bids for the construction of a 4 story, 43 x 133 ft. factory. K. E. Westerling, 116 War Eagle Bldg., Archt.

Kan., Atchison — Steinite Laboratories, manufacturers of radios, had plans prepared for the construction of a 4 story, 61 x 113 ft. factory. Estimated cost $175,000. Homer, Wyatt & Rhodes, 468 Bd. of Trade Bldg., Kansas City, Mo., Archts. Noted Mar. 3.

Mass., Brighton (Boston P. O.)—Heil Hoist Co., 298 North Harvard St., is having revised plans prepared for the construction of a 1 story service station at North Beacon and Market Sts. Krug & Smith, Milwaukee, Wis., Archts. Former bids rejected.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

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BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Mass., Cambridge (Boston P. O.)—National Biscuit Co., 85 Ninth Ave., New York, N. Y., is receiving bids for the construction of addition to garage at Albany and Pacific Sts. here. J. R. Torrance, 85 Ninth Ave., New York, Archt.

Mass., Cambridge (Boston P. O.)—R. H. O'Neil, 1384 Massachusetts Ave., awarded contract for the construction of a 1 story, 100 x 120 ft. repair and service garage. Estimated cost $40,000. Noted Jan. 6.

Mass., Springfield—Boston & Maine R.R., Boston, awarded contract for the construction of a 1 story, 79 x 194 ft. round house and repair shop on Columbus Ave. here. Estimated cost $73,000. W. J. Backes, Ch. Engr.

Mo., Kansas City — The Woods Bros. Corp., Security Bldg., plans the construction of a large shipyard to care for its present equipment, also constructing new power boats and barges to be used in commercial towing of freight.

N. J., Perth Amboy—Perth Amboy Dry Dock Co., Broad St., plans to rebuild 2 story factory recently destroyed by fire. Estimated cost $100,000. Architect not selected.

N. Y., Long Island—Meurer Steel Barrel Co., 23 West 43rd St., New York, awarded contract for the construction of a 1 story, 50 x 180 ft. addition to plant here. Estimated cost $175,000.

N. Y., Port Chester—The Port Chester Iron Works, Inc., Traverse St., awarded contract for the construction of a 1 story, 50 x 76 ft. plant on Soundview Ave. Estimated cost $23,000. R. Vickers, Bar Bldg., White Plains, Archt.

N. Y., Syracuse — Bd. of Contract & Supply will soon award contract for the construction of two 1 story, 50 x 100 and 60 x 200 ft. shops. N. F. Pitts, Jr., City Hall, Engr. Noted Feb. 10.

N. Y., Syracuse—The White Motor Co. H. R. Hadlow, Const. Engr., 842 East 79th St., Cleveland, O., will soon award contract for the construction of a 1 story sales and service station here. Estimated cost $150,000. Private plans.

N. Y., Utica—T. H. Williams, Deveroux Bldg., Archt., is preparing preliminary plans for the construction of a 4 story repair and service garage. Estimated cost $100,000. Owner's name withheld.

N. C., Lexington — Hackney Mfg. Co., recently incorporated, is having plans prepared for the construction of a 2 story, 60 x 145 ft. plant for the manufacture of chairs, to replace factory of the Lexington Chair Co., recently destroyed by fire. Estimated cost $85,000.

O., Alliance—Alliance Toy & Specialty Co., O. W. Lewis, Gen. Mgr. manufacturers of grass shears, toy wagons, etc., plans the construction of a 1 story, 20 x 140 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Iten Fibre Co., 2359 East 67th St., awarded contract for the construction of a 1 story, 50 x 130 ft. factory at 4321 Bower Ave. Estimated cost $40,000.

O., Cleveland—The Ohio Boxboard Co., C. W. Hackett, Secy., 1390 East 30th St., awarded contract for the construction of a 2 story, 60 x 120 ft. addition to factory. Estimated cost $75,000. Noted June 23.

Okla., Tonkawa—Williams Iron Works, awarded contract for the construction of a 1 story, 31 x 150 ft. machine shop. Estimated cost $40,000.

Pa., Franklin—The Chicago Pneumatic Tool Co., 572 West Randolph St., Chicago, Ill., is having plans prepared for the construction of a 100 x 293, 180 x 220 and 60 x 350 ft. factory here. Estimated cost $300,000. E. McGeorge, 3030 Euclid Ave., Cleveland, O., Archt. and Engr.

R. I., Providence—The White Co., East 79th St. and St. Claire Ave., Cleveland O., is receiving bids for the construction of a 2 story, 100 x 200 ft. repair and service garage at Branch Ave. and Dryden Lane here. Estimated cost $100,000. Private plans. Noted Jun. 9.

Tenn., Cleveland—Taylor Plow Co., D. R. Bacon, pres., Waterhouse St., manufacturers of tractor disc plows, plans the construction of a 50 x 125 ft. plant.

Tex., Corpus Christi—Alamo Iron Works, 130 Santa Clara St., San Antonio, plans the construction of a 2 story, 127 x 300 ft. steel fabricating plant here.

Tex., San Antonio—Smith Bros. Properties Inc., c/o Plaza Hotel, awarded contract for the construction of a 4 story, 80 x 190 ft. garage at Bowens Island and Villita St. Estimated cost $125,000.